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ABSTRACT

This newsletter contains items of interest to anyone concerned with science and society interactions. The first section of this issue contains 28 news items including program descriptions, information about meetings and publications, and discussions of issues related to science. The feature articles included are a legislative report on the U.S. House of Representatives and recombinant DNA; a personal commentary on science, the media, and the public; the Office of Technology Assessment looks at emerging technologies, and a discussion of the right to know and the right to create. Also included in this issue are a meetings calendar and a general bibliography. (BB)

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NEWSLETTER
ON

SCIENCE, TECHNOLOGY, & HUMAN VALUES

U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

April 1978
Number 23

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A few copies of earlier issues are still available.

For instructions to contributors, see inside back cover.

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To Our Readers

The April and June 1978 issues of the Newsletter on Science, Technology, and Human Values will be distributed without charge to

1) our present subscribers, and

2) other persons, institutions, or libraries identified as interested in the area of science and ethics.

If you do not wish to receive the June issue, please notify us immediately. If you have received more than one copy, please pass the extra Newsletter(s) on to a colleague.

For your convenience, a form is provided on page 59, on which you may request to be placed on or taken off the mailing list, comment on the Newsletter, or notify us of any address change or correction.

Free distribution is made possible by a grant from the National Endowment for the Humanities.

I. NEWS ITEMS

A. Can Science Be Measured?: Recent Assessments of the Health of Science

Continuing efforts to assess the status of science and technology in the U.S., both quantitatively and qualitatively, and to analyze the assumptions underlying such assessments, are represented by several recent publications. 1) Science Indicators - 1976 (SI-76) is the most recent compilation of quantitative measures ("science indicators") to be issued by the National Science Board. (Similar volumes were issued as SI-72 and SI-74.) Clearly presented and replete with numerous "appropriate caveats," SI-76 provides indicators of the status of science and technology in the various sectors of the U.S. economy. Results are described in six chapters: (1) "International Indicators of Science and Technology;" (2) "Resources for Research and Development;" (3) "Resources for Basic Research;" (4) "Industrial R&D and Innovation;" (5) "Science and Engineering Personnel;" (6) "Public Attitudes Toward Science and Technology."

Some key findings:

- Measured in current dollars, there has been a rise in: national expenditures for R&D; Federal expenditures for R&D; and national spending for basic research. Measured in constant dollars, however, the data reveal a different picture: in 1976, national R&D expenditures were only 2.5% above the 1974 total; 1976 expenditures for Federally supported R&D were 18% below the peak 1967 level; 1976 expenditures for basic research advanced about 3% over the 1975 level but were nearly 11% below the 1968 level.

- In 1975, there were 531,000 scientists and engineers (on a full-time-equivalent basis) engaged in R&D; this is 9,000 more than the 1973 level, but 28,000 fewer than the 1969 level.

- The proportion of young doctoral faculty in Ph.D.-granting science and engineering departments declined from 43% in 1968 to 27% in 1975. Over 70% of doctoral faculty in all fields had tenure in 1974.

Data for the chapter on public attitudes are drawn from a survey commissioned specifically for the report, and are grouped for discussion into four sections: general attitudes, results of science and technology, capabilities of science and technology, and public preferences. Attitudes expressed by the total public are compared with those of demographic groups that diverged most significantly from the total. There is also comparison with results of the 1972 and 1974 surveys, and with other surveys in which similar questions have been asked.

According to the survey results, the public's esteem for scientists in 1976 was second only to its esteem for physicians. About 70% of the public believed that science and technology have changed

life for the better, while 7% believed the change to have been for the worse. Asked who is most at fault when science and technology cause problems, 60% blamed government decisionmakers, 14% blamed persons in business, 7% blamed engineers and technologists, and 5% blamed scientists. A sizable minority of the public (31%) believed that societal control over science and technology should be increased; 45% said that control should remain as it is, and 10% that control should be increased.

Science Indicators - 1976 (340 pp.) is available from the U.S. Government Printing Office, Washington, D.C. 20402. Stock number: 038-000-00314-1; price, $4.75.

2) The essays in the volume Toward a Metric of Science: The Advent of Science Indicators offer analyses of the concept of science indicators from the standpoints of the history, sociology, political science, and economics of science. Described by the editors as a "venture into the applied historical sociology of science," the volume derives from a 1974 conference convened shortly after the appearance of the National Science Board's first science indicators report, Science Indicators - 1972. The purpose of that meeting and the present volume were described in the invitation to the conference:

> We should like to pose the question, "What must one look at in order to estimate the condition of science as an intellectual activity or as a social institution?" We think of this question within a broad historical and sociological frame rather than from a delimited point of view dealing with the present inputs to and outputs of science measured in terms of men, money, and materials. We think that our discussion of Science Indicators should be problem oriented...
>
> At best, we will be starting an ongoing activity, designed to enlarge the scope and conceptual framework of thinking about science. (p. ix)

Twelve essays are included:

"Measurement in the Historiography of Science," by Arnold Thackray;
"Science Indicators and Social Indicators," by Otis Dudley Duncan;
"Can Science Be Measured?" by Gerald Holton;
"Toward a Model for Science Indicators," by Derek de Solla Price;
"Models of Scientific Output," by Manfred Kochen;
"Taking Data Seriously," by William Kruskal;
"Economic Problems of Measuring Returns on Research," by Zvi Griliiches;
"Citation Data as Science Indicators," by Eugene Garfield, Morton V. Malin, and Henry Small;
"Measuring the Cognitive State of Scientific Disciplines," by Stephen Cole, Jonathan Cole, and Lorraine Dietrich;
"Difficulties in Indicator Construction: Notes and Queries," by Hans Zeisel:
"From Parameters to Portents - and Back," by John Ziman;
"Political Contexts of Science Indicators," by Yaron Ezrahi.

Toward a Metric of Science: The Advent of Science Indicators. Edited by Yehuda Elkana, Joshua Lederberg, Robert K. Merton, Arnold Thackray, and Harriet Zuckerman. New York: John Wiley & Sons, Inc., 1978.

3) The condition of the scientific research effort in the nation's universities is the subject of The State of Academic Science, by Bruce L.R. Smith and Joseph J. Karlesky (New York: Change Magazine Press, 1977). Based on a two-year study that included many site visits to public and private universities across the country, the work reviews the recent trends influencing academic science and assesses the prospects for the future. Findings are presented in six major chapters: I. The Universities' Role in the Nation's R&D Effort; II. Trends in the Support and Performance of Academic Science; III. The Changing Relationships: Universities and Other R&D Performers; IV. Current Developments in Academic Science and Engineering (chemistry, physics, mathematics, life sciences, engineering); V. Emerging Issues in Academic Research (supporting resources for research, manpower problems, deteriorating government/university relations, indirect costs); VI. Conclusions.

According to the authors: "The basic findings are seemingly contradictory: While research of the highest quality continues to characterize academic science, with sometimes exceptional achievements, there are also the beginning signs of deterioration. A significant underlying problem that heightens the impact of adverse trends is the weakening financial condition of many universities. Important choices about the research role of universities in the next decade will be posed in an atmosphere of rapid change."

See also the companion volume, The State of Academic Science: Background Papers, Bruce L.R. Smith and Joseph J. Karlesky, eds. (New York: Change Magazine Press, 1978). In addition to an introduction by the editors, the contents are: "Forces Affecting the Research Role of Universities," by Dael Wolfle; "The Changing Relationships: Universities and Other R&D Performers," by Walter S. Baer; "Targeted Research: An American Tradition," by Carl M. York; "Effects of Recent Trends in Graduate Education on University Research Capability in Physics, Chemistry, and Mathematics," by David W. Breneman; and "Accountability and the Research Universities," by Sanford A. Lakoff.

B. Women in Science: New Data, New Bill

At a "Participation of Women and Men in Scientific Research" symposium at the 1978 AAAS Meeting, Betty M. Vetter of the Scientific Manpower Commission pointed out that although recent tabulations show that the number of women entering science and engineering has been increasing rapidly since the 1950's, "women still constitute less than 10% of all doctoral scientists and engineers in the labor force."[1] Moreover, their share of the earned doctorates in the sciences is only slightly larger in the 1970's than in the 1920's, since the number of science doctorates earned by men has also increased in that period.

These and similar statistics on unemployment rates and salary scales for women scientists and engineers form the underlying justifications for the introduction in February 1978 of Senate Bill 2550, the "Women in Science and Technology Equal Opportunity Act."

By establishing a 10-year program spearheaded by activities of the National Science Foundation (NSF), the Bill seeks to reduce educational, cultural, and institutional barriers to the full representation of women in all areas of science and engineering. Co-sponsored by Senators Edward Kennedy (D-Mass.), William Hathaway (D-Maine), Jacob Javits (D-N.Y.), Claiborne Pell (D-R.I.) and Harrison Williams (D-N.J.), S. 2550 encourages the development of programs and procedures that:

1) improve science education, particularly in mathematics;
2) promote literacy in science and mathematics for young women planning scientific, technical, or other careers;
3) increase employment opportunities for women;
4) encourage the participation of minority and handicapped women; and
5) educate and inform the public concerning the importance of participation by women in science and technology.

To accomplish these goals, the Bill proposes:

1) Educational programs--elementary school through university--to develop methods and materials discouraging attrition from science and math courses; other vehicles such as workshops or fellowships that would target the specific needs of different groups of women and the varieties of barriers faced during education;

2) Public understanding programs--research, media, and museum programs, and publications--to promote scientific and technical careers for women and perhaps to change many of the discouraging public images and stereotypes of women scientists in particular and science in general; the Bill also directs the NSF to support community outreach activities on this subject;

3) Awards to recognize achievement by individuals or institutions, and to provide incentives for primary and secondary schools which encourage young women to enroll in science and math courses;

4) Additional activities include a Visiting Women Scientists program, and the establishment of a Clearinghouse on Women in Science, which would aid employers--in both the public and private sectors--in the identification of qualified women scientists and engineers.

The recent increase in first-year women engineering students, up 623% from 1969 to 1975, demonstrates that the situation in some fields can be changed.[2] Although this increase is not yet reflected in graduate engineers or in the engineering employment statistics, the proportion of students who are women has been increasing at the baccalaureate level. However, rather than wait for incremental improvements in individual fields or professions or rely on the efforts of women's rights groups, S. 2550 clearly mandates the NSF--through instruction and eventual appropriation, the Civil Service Commission, and the heads of appropriate Federal agencies to act now to "maximize the potential contribution and advancement of women in scientific, professional and technical careers" and thereby to "promote the full use of human resources in science and technology."[3]

NOTES

1. Betty M. Vetter, "Data on Women in Scientific Research," presented at AAAS, 144th Annual Meeting, February 15, 1978, Washington, D.C.

2. Ibid.

3. For a summary of S. 2550, see Congressional Record, Vol. 124, No. 21, 21 February 1978.

C. AAAS Surveys Needs of Science Policy Community

In the Spring of 1977 the AAAS Committee on Science and Public Policy established a Working Group on Science, Technology and Public Policy (STPP) Networking. Charged with assessing the needs of the science policy community, the Working Group began its analysis by posing the following questions: What steps could be taken to foster training, research, and utilization of results? How could networks of scholars and practitioners be established? What could be done to assist university-based programs in science, technology and public policy in their efforts to give the field a greater measure of coherence, utility and recognition?

In September 1977 the Working Group sent questionnaires to about 3700 members of the STPP community in universities, industry and government. It asked for their views on the needs of the field and how the AAAS could assist in meeting them. The 720 responses yielded the following results:

- no single activity was clearly preferred to any other;

- highest priority was given to the establishment of workshops or other exchanges to facilitate the application of disciplinary expertise to STPP problems and the dissemination of results;

- almost as high priority was given to: a newsletter to serve as a communications link; a monograph series on key policy issues; an annual survey of how the academic STPP field is presently relating and might better relate to national and regional needs;

- establishment of a professional STPP organization received a significantly lower priority than other activities.

The Committee on Science and Public Policy, now under the leadership of Melvin Kranzberg, is currently considering a program of activities designed to meet the needs expressed in the survey. Copies of the report on the survey results may be obtained from: Don Phillips, Office of Public Sector Programs, AAAS, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.

D. Sigma Xi National Lecturers for Academic Year 1978-79

Each year Sigma Xi sponsors an outstanding group of nationally-known scientists willing to lecture on "particularly lively areas of current research in a manner appropriate for interdisciplinary audiences." The lecturers serve from July 1978 through June 1979 and consent to limit honoraria to $150 per lecture plus travel costs and subsistence. Lectures must be sponsored by the local Sigma Xi group and arrangements made with the individual lecturer and the Chairperson of the Sigma Xi Committee on Lecturerships. As American Scientist has pointed out, the program enables Sigma Xi members and colleagues to sponsor public lectures of interest to both science and non-science students in a manner attainable during a period of fiscal constraint at many institutions. While most of the twenty-eight 1978-79 lecturers will address specific scientific or technical subjects, some will be concerned with aspects of the ethical and social dimensions of science or social science:

Daniel Bell (Harvard University), "The Return of the Sacred? The Argument on the Future of Religion" and "Future World Disorders: The Structural Context of Crises;"

James E. Bowman (University of Chicago), "Genetics Programs and Public Policies," "Ethical, Legal, and Economic Issues in Sickle Hemoglobin Programs" and "Malaria, Genes, and History;"

Franklin A. Long (Cornell University), "The U.S. Programs of Military R&D: What For and How Much?" and "Applying Science and Technology to International Development;"

Simon Ostrach (Case Western Reserve University), "Interaction of Cultures: Engineers with Lawyers and Physicians;"

Stanford S. Penner (University of California-San Diego), "Developing Energy Technologies" and "Environmental Impact Assessments of Escalating Energy Use;"

Duane H.D. Roller (The University of Oklahoma), "Science and Beauty: The Renaissance of Science" and "The Origins of Science in Greek Antiquity;"

Robert E. Schofield (Case Western Reserve University), "Artistic Themes and Literary Paradigms: The Cultural Content of Science," "Dr. Faustus to Dr. Strangelove: A History of the Two Cultures," and "Theology, Physics, and Metaphysics: Unity and Utility in Joseph Priestley's Thought;"

Arnold Thackray (University of Pennsylvania), "The Human Dimensions of Science" and "The Invention of the Scientist;"

Alvin M. Weinberg (Institute For Energy Analysis), "Reflections on the Energy Wars" and "Trans-Science and the Limits of Science."

A full list of the lecturers (with biographical sketch) and lecture topics is given in the January/February 1978 American Scientist; or you may write to John W. Prados, Chairman, Committee on Lectureships, Sigma Xi, 345 Whitney Avenue, New Haven, Connecticut 06511.

E. AAAS Committee on Scientific Freedom and Responsibility

1977 marked the first full year of operation for the AAAS Committee on Scientific Freedom and Responsibility (CSFR). Major program activities undertaken during that year include the creation of a clearinghouse on persecuted foreign scientists, review of individual claims of violations of scientific freedom in the United States, and a study of alternative due process and appeal mechanisms for scientists and engineers involved in whistleblowing issues. Details of these and other initiatives are described in the Committee's 1977 Annual Report. In addition to a list of recent articles on the Committee or Committee projects, the report includes a brief general bibliography. An appendix contains four papers presented at the 1977 AAAS Symposium on CSFR:

- "Charge to the AAAS Committee...," Bentley Glass;
- "Scientific Freedom and Human Rights," John T. Edsall;
- "The Boundaries of Scientific Freedom," Harold P. Green; and
- "The Defense of Professional Freedom and Social Responsibility," Frank Von Hippel.

Copies of the 58-page report are available for $2.00 (prepaid), from the American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington, D.C. 20005.

F. Survey of Sources in the History of Biochemistry and Molecular Biology

After sponsoring two conferences on the history of biochemistry since 1970,[1] the Committee on the History of Biochemistry and Molecular Biology of the American Academy of Arts and Sciences realized that a systematic assay of primary historical documents would greatly assist scientists and historians in explaining key events in the history of biochemistry and related fields. Historical disputes could be better resolved if, at future conferences, historians, sociologists and philosophers of science could meet with scientist/participants to discuss source materials such as personal correspondence and laboratory notes, relating to one or several specific discoveries. Therefore, to locate such primary source materials, the Committee joined with the American Philosophical Society to sponsor a one-year "survey" of archival holdings concerning the history of biochemistry and molecular biology.[2]

Almost immediately after the Survey was organized in Spring 1975, a search of published, if ephemeral, archival directories revealed a wealth of documentary material previously unknown to scholars in the field. Beginning in 1975, the Committee sought and received funding from the National Science Foundation, the National Endowment for the Humanities, Merck Laboratories, Inc., and the Commonwealth Fund, to extend the originally modest survey as a service to several audiences: archivists, scientists and students of the intellectual and social development of science.

Since July 1976, the Survey of Sources for the History of Biochemistry and Molecular Biology has conducted systematic searches for personal and institutional records of scientific activity that have not yet been deposited in public repositories, and has directed owners of such materials to scholarly institutions willing to accept historical records and open them to research. The Survey has also gathered autobiographical accounts from over five hundred living scientists and generated information on sources of funding for biochemistry and molecular biology research, avenues for publication, and professional associations. In addition, the Survey has documented the extent of already deposited materials concerning the history of biochemistry and related experimental life-sciences, both in the U.S. and abroad. These activities are reported in an occasional, free publication, Survey of Sources Newsletter.

Other activities of the Survey involve services provided to scholars of the history and sociology of the life sciences and archivists who are compiling papers deposited in their institutions. The reference service of the Survey is the responsibility of David Bearman, who since 1975 has acted as manager of the Survey's projects and as Secretary to the American Academy of Arts & Sciences Committee. With the assistance of computer programs designed by the Survey staff for its archival and bibliographic data, numerous researchers have been directed to materials, both published and unpublished, which would otherwise be unlikely to come to their attention. Using modifications of the same software, the Survey can also generate--from descriptions

of archival collections provided by archivists and from descriptions written by Margaret Miller (Archival Projects Supervisor of the Survey)--indexes to collections in archival repositories. In addition, the Survey can provide to archivists, and their patrons, records of related materials which are housed in collections throughout the world.

The Survey of Sources was designed for scholars from many disciplines; historians, philosophers, anthropologists, sociologists, psychologists and scientists all have interests in the development of modern science and their perspectives are increasingly employed in discussions of social policy. Materials concerning American philanthropic foundations, the personal papers of scientists, science administrators and popularizers, and the evidence of public interest in science, should aid the research of many different scholars. The Survey recently added descriptions of the Recombinant DNA archives at the Massachusetts Institute of Technology.

The Survey welcomes inquiries and requests for information about its activities and would be grateful for any assistance in locating and documenting materials concerned with the history of biochemistry and molecular biology. For further information, write: David Bearman, Survey of Sources, American Philosophical Society Library, 105 South Fifth Street, Philadelphia, Pennsylvania 19106.

NOTES

1. American Academy of Arts and Sciences, Proceedings of the Conference on the History of Biochemistry and Molecular Biology (1970); also see Proceedings of the Conference on the Historical Development of Bioenergetics, 11-13 October 1973 (1975).

2. For a more detailed account of the history and purposes of the Survey, see: Federation Proceedings 36 (1977), 2069-2073, or Annals of Science 33 (1976), 395-97.

G. New Data Base: BIOETHICSLINE

The Kennedy Institute announces that BIOETHICSLINE is now available as one of the computerized literature retrieval services of the National Library of Medicine. The BIOETHICSLINE data base contains bibliographical information on questions of ethics and public policy arising in health care and biomedical research. Topics covered include informed consent, confidentiality, euthanasia, the allocation of medical resources, research involving human subjects, genetic intervention, behavior control techniques, and Recombinant DNA research.

Developed at the Center for Bioethics by the Information Retrieval Project, under the direction of LeRoy Walters, BIOETHICSLINE includes English-language materials published from 1973 to the present. The data base incorporates journal and newspaper articles, monographs, court decisions, bills, statutes, and audiovisuals, selected from the literature of medicine, nursing, the biological sciences, philosophy, religion, law, and the behavioral sciences, as well as from the popular media. Currently BIOETHICSLINE contains 5,000 records and is updated every four months. Approximately 1,500 records will be added each year.

For further information, contact Maureen L. Canick, Senior Bibliographer, Information Retrieval Project, Center for Bioethics, Kennedy Institute, Georgetown University, Washington D.C. 20057; (202)-625-2371.

H. Western Science and Public Policy Communications Center

Television station KPBS in San Diego, California, has established a Western Science and Public Policy Communications Center for the production of documentaries on regional policy issues with a significant scientific and/or technological component. Directed by Dr. Jeffrey Kirsch, the project is receiving major support from NSF's Public Understanding of Science Program, with additional support from Sigma Xi. According to a KPBS announcement, the programs "are designed to improve public understanding of science-related policy issues and to stimulate participation of ... citizens and scientists in Western regional policy decision-making processes." Guidance for the series is provided by a Science Technology Advisory Panel and program managers of Western public television stations.

Documentaries already released or in production include: "Alaska Oil: America's Pipe Dream?" (broadcast nationally by PBS stations on March 2); "The President's Scientist: A Conversation with Dr. Frank Press;" "The California Water Resources Program" (scheduled for release in April 1978); and "The Cancer Habit" (on recent developments in short-term screening for environmental carcinogens; targeted for release in June 1978).

Transcripts of "The President's Scientist" are available. Requests for transcripts and additional information about the project should be addressed to: Ms. Judith Adams, Promotion Coordinator, KPBS-TV, 5164 College Avenue, San Diego, California 92182.

I. Washington Area Seminar on Science, Technology and Ethics

The Kennedy Institute at Georgetown University hosts a monthly invitational seminar on ethical issues in science and technology. Congressional staff members, officials from several science-related Federal agencies, faculty members of Washington-area universities,

and members of scientific organizations are among the regular participants in the seminar.

Each seminar session includes a formal presentation and discussion, as well as dinner and social hour. Topics for discussion during the 1977-78 seminar series have been Recombinant DNA research, a hypothetical clinical trial of Laetrile, the social responsibility of the scientists involved in the Manhattan Project, research involving children, and the proposed revision of the Federal Food, Drug, and Cosmetics Act. Seminar speakers have included Burke Zimmerman (House Subcommittee on Health and the Environment), Herman Lewis (NSF), Mortimer Lipset (NIH), Philip Morrison (MIT), Albert Jonsen (University of California at San Francisco), and Donald Kennedy (FDA).

A Coordinating Committee comprised of William Blanpied (NSF), Barbara Culliton (Science), Charles McCarthy (NIH), and LeRoy Walters (Kennedy Institute) assists in planning the seminar sessions. Inquiries about the seminars should be directed to the Coordinating Committee, Washington Area Seminar, c/o Center for Bioethics, Kennedy Institute, Georgetown University, Washington, D.C. 20057.

J. Planning Awards for NEH Youth Projects

Awards designed to encourage the development of innovative humanities programs for youth will be provided in 1979 by the National Endowment for the Humanities to 100 organizations qualifying for planning support grants. This NEH program recognizes that a period of careful preparation is often essential to developing successful resource materials, outreach programs, group research projects, workshops, media projects, and other activities in the humanities. The Planning Awards of $2500 will provide funds for necessary staff, consultants, travel, and resources during the development of programs that creatively utilize and link community resources at either the local, state, or national level. One suggestion offered by the Endowment in its press release was that "Professionals in youth programming can work together with humanists such as university professors and museum curators to plan projects that will involve large numbers of young people in humanities activities during after-school hours, weekends, and vacation." Planning Awards must focus on the disciplines of the humanities (including history, philosophy, literature, history and criticism of the arts, and those aspects of the social sciences employing historical or philosophical approaches) and organizations should consult with humanists in the planning for a project. For example, an historian or archaeologist could help to design a project in regional history; a philosopher could work with a youth programming staff to develop resource materials for a project in ethics; or an anthropologist or ethnic historian could suggest ways of introducing children to the range of subcultures and ethnic traditions alive in their locality.

Institutions and organizations eligible to apply for Planning Awards include non-profit civic, cultural, educational, media, and youth groups. Individuals may also apply, provided they have the sponsorship of an organization. Application deadline is June 1, 1978, for Planning Awards to be announced in October. For additional information, write: Planning Awards for NEH Youth Projects, Office of Youth Programs/Mail Stop 103, National Endowment for the Humanities, Washington, D.C. 20506.

K. National Commission Sets Guidelines for Research on Institutionalized Mental Patients

Continuing its assessment of the need for special guidelines for research with special subject populations, the National Commission for the Protection of Human Subjects has issued its latest study, Report and Recommendations: Research Involving Those Institutionalized as Mentally Infirm. The Commission has previously issued recommendations for fetal research, research with prisoners, and research involving children. The latest report has been submitted to the Secretary of HEW who is required, by law, to propose regulations to implement the Commission's recommendations or explain any decision not to do so.

Single copies of the Commission's report are available from: Ms. Betsy Singer, Public Information Officer, National Commission for the Protection of Human Subjects, 5333 Westbard Avenue, Westwood Building, Room 125, Bethesda, Maryland 20016.

L. Science, Health and Environmental Communications Newsletter

Not every informal or ad hoc group of busy persons with similar interests is able to complete successfully all the proposals and promises made in the heat of shared discussion. At four different meetings during the Annual convention of the Association for Education in Journalism (AEJ) held in August 1977,[1] a group of journalism faculty members who teach science, health or environmental writing expressed their needs for more formal means of communication. They developed three proposals: 1) to circulate a listing of those present at the meetings; 2) to initiate an informal newsletter and 3) to explore the possibility of holding a longer session devoted exclusively to science writing at the next AEJ meeting. The listings were sent out in mid-fall by Sharon Friedman (Lehigh University); a day-long symposium on science writing will be held in August 1978 (see News Item Y in this issue); and in January 1978 the first issue of the SHEC Newsletter appeared. Editor Joye Patterson (University of Missouri) plans to publish a second issue in late Spring 1978.

Persons teaching science writing courses--in science and engineering as well as journalism departments--are invited to be placed on the mailing list for the Science, Health and Environmental Communications Newsletter. Write: Professor Joye Patterson, School of Journalism, University of Missouri, Columbia, Missouri 65201.

NOTES

1. For a report on those meetings, see Newsletter #21 (October 1977), pp. 4-6.

M. National Directory of Science Communication Courses and Programs

Notable changes in the number and type of schools offering instruction in the communication of science prompted the authors of this Directory to examine the particular programs and compile a guide for teachers, researchers and potential students. For fifty-eight American colleges and universities, the Directory lists 34 programs and 105 courses which have a "significant component devoted to teaching science communication to the general public," with an emphasis on public communication rather than communication to specialized audiences, internal or technical communication. More than 40% of the courses teach traditional science writing, but many courses concentrate on policy, history, and theory of science communication, and others address writing or reporting on specific science-related issues (such as energy or the environment) or science-related fields (such as agriculture or engineering). The entry for each school lists course descriptions, type and number of students, and full address (and often telephone number) of the instructor and program director. Further research in this area will, we hope, concentrate on where these students are placed after graduation and on the amount and type of training in science either required by the programs or otherwise obtained by the student.

First publication was February 1978; the authors anticipate future updates and welcome contributions from schools not listed in this version. The 46-page Directory of Science Communication Courses and Programs, compiled by Sharon M. Friedman (Lehigh), Rae Goodell (MIT) and Lawrence Verbit (SUNY-Binghamton) may be obtained for $4.95 from: Science Communication Directory, Department of Chemistry, State University of New York at Binghamton, Binghamton, N.Y. 13901.

N. Annotated Collection Guide to Literature on Technology and the Humanities

Extensive annotation of the primary sources in the growing humanities-technology literature highlight this 63-page paperbound collection guide. Entries include overviews of the field, anthologies, historical studies, fiction and poetry, case studies, journals and relevant books from the fields of art, architecture and urban design, literature, technology assessment, philosophy, and ethics. Beyond Technics: Humanistic Interactions With Technology, a basic collection guide, by Judith Mistichelli and Christine Roysdon of the Lehigh University Library, is published by the Humanities Perspectives on Technology Program at Lehigh. A useful guide for researchers, teachers, students and librarians. The Guide may be ordered for $2.00, prepaid, from Humanities Perspectives on Technology, Maginnes Hall #9, Lehigh University, Bethlehem, Pennsylvania 18015.

O. Philosophy of Technology Bibliography

Under a grant from the National Science Foundation and the National Endowment for the Humanities, Carl Mitcham, St. Catharine College (Kentucky) is producing an annual annotated bibliography of the philosophy of technology. Future bibliographies are now scheduled for publication in Research in Philosophy and Technology and, to facilitate the preparation, Mitcham requests that authors send him copies of any work they feel should be included. Readers are also encouraged to submit annotations--especially of foreign language works--and to contribute comments and suggestions.

This project continues Mitcham's previous work in this area; see Carl Mitcham, Bibliography of the Philosophy of Technology (Chicago: University of Chicago Press, 1973) and "Current Bibliography of the Philosophy of Technology: 1973-74," Research in Philosophy and Technology 1 (1977). Address all correspondence to Carl Mitcham, St. Catharine College, St. Catharine, Kentucky 40061.

P. NSF Report on Scientific and Technical Communication Activities in the Federal Government

According to a report recently issued by the National Science Foundation, federal agencies are making more intensive use of communications and systems technology to meet specialized scientific and technical information needs. The report, Federal Scientific and Technical Communication Activities: 1976 (NSF 77-64), describes scientific and technical information programs in sixteen Federal executive departments and independent agencies, the Smithsonian Institution, the Library of Congress and the Government Printing Office. An introductory chapter summarizes recent developments and such trends as: 1) a resurgence of interest at high policy levels in the roles played

by information systems in both national and international affairs; 2) a steady growth of the information services provided by Federal agencies to other constituencies.

The 107-page report is available in paper copy ($6.50, domestic mailing) or microfiche ($1.00, domestic mailing) from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. Request Report PB 272-800.

Q. News About Energy Alternatives and Appropriate Technology

Acorn is a crisply-edited newsprint newsletter published under the sponsorship of the College of Environmental and Applied Sciences, Governors State University (Park Forest, Illinois). Many of the articles and columns describe activities in the area of alternative technologies, but Acorn also attends regularly to policy analyses and to educational efforts. Occasional interviews with practioners (architects, engineers, researchers, writers) provide useful glimpses of the "Alternative" trends in these fields. The "Media Watch" column consistently highlights varieties of science writing; a recent issue, for example, described current articles or the general tone of such a diverse group of publications as Popular Mechanics, Galaxy Science Fiction, Advertising Age and Atlantic Monthly.

Acorn is published ten times a year (no January or August issues); subscriptions are currently $6.00 for individuals, $10.00 for institutions. For more information, write Acorn/GSU, Park Forest South, Illinois, 60466 (312)-534-5000.

R. Articles for Anthology on Philosophical Issues Surrounding Suicide

David Mayo and M. Battin are seeking contemporary papers on suicide and related topics for consideration for anthology publication. Although the editors will consider previously published work, they prefer new papers and welcome abstracts, outlines, or inquiries from persons working in this area. Write: Professor David Mayo, Department of Philosophy, University of Minnesota, Duluth, Minnesota 55812; (218)-726-8548, (218)-724-7734. Deadline for consideration of manuscripts is 15 July 1978.

S. Birth Announcement: American Association for the Advancement of the Humanities

"The blunt truth is that everybody is organized but the humanists." So states the prospectus for the American Association for the Advancement of the Humanities, a AAAS-type organization for humanists that was incorporated last fall and will soon begin operations. Founded by

Professors James Banner and Theodore K. Rabb, both of Princeton, and John W. Shumaker, of the State University of New York at Albany, the AAAH is conceived as an "independent, national membership organization" whose broad purposes are "to promote the interests of the humanities in the United States and to foster greater public understanding of the importance of the humanities to American life."

One of the organization's principal goals is to encourage participation by humanists in debates on public policy issues. In Professor Banner's words, "(Humanists) have played no major role, for example, in the national debate over recombinant DNA research. They have offered no specially informed testimony before congressional committees investigating privacy, human rights, nuclear weaponry, or environmental protection." [Science 198 (2 December 1977), p. 902]. Long-term plans of the AAAH include conferences, congressional internships for humanists (similar to the Congressional Science fellowships), and publication of a regular newsletter, Washington Humanities Report.

Fund-raising efforts for the AAAH are now underway and activities are expected to begin shortly. For additional information, write to: Professor James M. Banner, Jr., Department of History, Princeton University, Princeton, New Jersey 08540.

T. Hastings Center to Sponsor Summer Workshops

Topics in medical and biological ethics will be featured in three summer workshops sponsored by The Hastings Center (Institute of Society, Ethics and The Life Sciences).

Workshop 1: Bioethics and Public Policy
June 25 - July 2, 1978; Sarah Lawrence College, Bronxville, New York
Director: John C. Fletcher
Staff: James Childress, Charles M. Culver, Patricia King, Bruce Miller

A survey of current issues in medical and biological ethics, with particular emphasis on public policy implications.

Workshop 2: Pediatrics, Ethics, and the Law
June 25 - July 1, 1978; Dominican College, San Rafael, California
Director: Albert R. Jonsen
Staff: William Bartholome, Angela Holder

Ethical and legal issues related to the medical and health care of children. Principal topics: care of the newborn and the chronically ill child; death of children; experimentation involving children; sexuality; child abuse.

Workshop 3: Medical Ethics in a Clinical Setting
July 16 - 23, 1978; Dartmouth College,
Hanover, New Hampshire
Director: Charles M. Culver
Staff: K. Danner Clouser, William Nelson, and
clinical staff from the Dartmouth-Hitchcock
Medical Center

Exposure to a clinical setting for humanists with theoretical sophistication in medical ethics.

For information about fees and lodging, write to: Workshops, The Hastings Center, Institute of Society, Ethics, and the Life Sciences, 360 Broadway, Hastings-on-Hudson, New York 10706.

U. Institute on the History of 19th Century Science: May 23-26, 1978

In May 1978, the Educational Trust Fund of the Pennsylvania State College and University system will sponsor a four-day institute on selected topics in the history of 19th Century science, with emphasis on "the age of the earth" controversy. Four lectures will be given by distinguished historians of science, and the conference will include both formal and informal discussion periods. Persons interested in attending should contact Dr. David L. Wagner, Department of Physics, Edinboro State College, Edinboro, Pennsylvania 16444; (814)-732-2516.

V. Ethics and Public Policy Workshop: 18-24 June 1978

Participants in this forthcoming workshop will examine a variety of issues which concern ethics and public policy. Political scandals, questioning of foreign policies, and the ethical issues raised by government-supported research programs have increased the need for discussion of issues of public policy within the context of emerging ethical or values questions. This workshop, jointly sponsored by The Center for Philosophy and Public Policy and The Hastings Center, includes a full agenda of speakers, small seminars, and informal sessions on teaching ethics and public policy. Topics to be examined include: moral issues in determining whether certain groups should be given favorable treatment in reparation for past injustices; how health care costs can be fairly kept within reasonable bounds; is there a right to a guaranteed annual income; are some human rights more important than others; and the nature of ethical reasoning.

The Workshop will be held at St. John's College, Annapolis, Maryland; workshop fee is $225; dormitory accommodations are available for the week-long event. For further information, write: Peter G. Brown, Workshop on Ethics and Public Policy, Center for Philosophy and Public Policy, University of Maryland, College Park, Maryland 20742.

W. Colloquium on Research and Development in the Federal Budget and in Industry

On June 20 and 21, 1978, the AAAS Committee on Science and Public Policy will sponsor the third annual AAAS Colloquium on R&D in the Federal Budget. The colloquium, which will be held at the Mayflower Hotel, Washington, D.C., will focus this year on the impact on R&D of the first complete Carter budget, trends and problems of R&D in industry, and the impact of R&D on the economy.

Research and Development: AAAS Report III, by Willis H. Shapley and Don I. Phillips, will be available in book form for the June colloquium and will contain a special section on R&D in industry and its impact on the economy. For information and reservations, write: Ms. Patricia S. Curlin, AAAS Office of Public Sector Programs, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036.

X. Science Week at the New York Academy of Sciences

"The Scientific Basis for the Public Health Control of Environmental Hazards" is the unifying theme of three conferences to be sponsored by The New York Academy of Sciences from June 21 to June 30, 1978, in New York City. Two of the conferences will be restricted to scientific and technical questions. The conference on "Health Effects of Asbestos Exposure," (June 24, 25, 27) will focus on recent progress in approaches to control, new information defining disease hazards, and current studies of epidemiologists, physicians, mineralogists, pathologists and others. Emphasis will be placed on the data needed to evaluate how hazards--particularly environmental cancers--are to be controlled. The conference on "Health Effects of Halogenated Aromatic Hydrocarbons" (June 24, 25, 27) will focus on the large group of chemicals which have found extensive application in the last several decades in chemical, plastics, and polymer industries, and about which there is considerable unease concerning health risks associated with their use.

Science Week will conclude with a third international conference on "The Public Control of Environmental Health Hazards" (June 28, 29, 30). Based in part on the data presented in the preceding meetings, this conference will direct attention to the use of accumulating scientific information to control environmental hazards. Topics scheduled for lectures and panel discussions include: "The consequences of environmental hazards to human health;" "Scientific uncertainties in evaluation of environmental disease;" "Public involvement in risk assessment and standard setting;" "International differences in decision-making on environmental controls: the case of vinyl chloride;" "Unresolved issues in the conflict between individual freedom and social control;" and "Media priorities and responsibilities." Representatives of the media, labor, industry, government and scientific and medical communities are slated to participate.

Further information and applications concerning "Science Week" are available from the Academy. Inquiries should be addressed to: Dr. Paul Milvy, Science Week Administrative Coordinator, The New York Academy of Sciences, 2 East 63rd Street, New York, N.Y. 10021.

Y. Science Writing to be Featured at Special Journalism Symposium, Seattle, Washington, August 12

A symposium for teachers of science and environmental writing will take place August 12 in a special pre-convention session of the Association for Education in Journalism (AEJ) Annual Meeting in Seattle, Washington. The "Symposium on Teaching Science and Environmental Writing: The Journalism of Uncertainty," is being coordinated by Phillip J. Tichenor (University of Minnesota) under sponsorship of the Teaching Committees of the Theory and Methodology Division and the Mass Communication and Society Division of AEJ.

An outgrowth of a series of special sessions on science, medical and environmental writing held during the 1977 convention [see "Science Writing Discussed by Journalism Association," Newsletter #21 (October 1977), pp 4-6], the symposium will examine some of the crucial questions faced by teachers in dealing with this specialized area. Six presentation-discussion sessions will be led by persons with a wide range of specialties and experience in teaching and writing in these areas: Everette Dennis (Minnesota) "Science and Environmental Writers: Their Values and Their Methods;" Rae Goodell (MIT) "Should Scientists be Involved in Teaching Science Writing--And If So, How?"; Clay Schoenfeld (Wisconsin) "An Educator's Perspective on Environmental Communications;" Sharon Friedman (Lehigh University) "The Case Study Approach to Teaching Science and Environmental Writing;" John Bowes and Keith Stamm (Washington) "Science Writing Techniques and Methods: What the Research Tells Us." Symposium moderators will be Joye Patterson (University of Missouri) and Hillier Krieghbaum (NYU, Emeritus).

In a wrap-up session sponsored by the Theory and Methodology Teaching Committee, Ellen Wartella and Sharon Dunwoody (Ohio State) and Sharon Friedman will describe particular programs on Science and Environmental Writing.

While there is no fee for attendance at the symposium, advance registration is requested. For further information, write Professor Phillip J. Tichenor, School of Journalism and Mass Communications, 111 Murphy Hall, University of Minnesota, Minneapolis, Minnesota 55455.

Z. Henry Schuman Prize for Essays in the History of Science

The $500 Henry Schuman Prize is awarded annually for an original prize essay in the history of science and its cultural influences.

The contest is open to graduate and undergraduate students in any American or Canadian college, university, or institute of technology. Papers submitted for the prize competition should be approximately 5,000 words in length, exclusive of footnotes, and thoroughly documented. It is hoped that the prize-winning essay will merit publication in Isis.

It was the wish of the donors that "history of science and its cultural influences" be interpreted broadly; therefore, papers may deal with the ideas and accomplishments of scientists in the past; they may trace the evolution of particular scientific concepts; or study the historical influences of one branch of science upon another. Essays dealing with medical subjects are not acceptable, although papers dealing with the relationship of medicine to the natural sciences will be welcome.

To be eligible for consideration, papers (not more than one from each competitor) should be sent to the Chairman of the Schuman Prize Committee, Dr. Harold I. Sharlin, Historian's Office, C-478, Executive Secretariat, U.S. Department of Energy, Washington, D.C. 20545, on or before July 1, 1978. Entries with later postmarks will be returned. Three copies of each essay should be submitted; names and institutions of the contributors should be placed on a separate title page.

AA. Faculty Position Available in Cornell STS Program

The Program on Science, Technology and Society, at Cornell University is seeking an Assistant Professor of Biology and Society. Applicants should be biologists whose scientific interests are appropriate for appointment in the Division of Biological Sciences in the area of the human implications and social impact of biology. This position is a junior, tenure-track appointment to be made jointly by the Program on Science, Technology and Society and the Division of Biological Sciences. The appointee will be expected to maintain an active research program and to participate in teaching the Biology and Society Course as well as other courses such as Biomedical and Environmental Ethics.

Applications should include a curriculum vitae, a statement of research and teaching interests, and the names of three references. Application materials should be sent to: Dr. Stuart M. Brown, Jr., Associate Director, STS Program, 624 Clark Hall, Cornell University, Ithaca, New York 14853.

Deadline for applications is May 1, 1978. Cornell University is an Equal Opportunity/Affirmative Action Employer.

BB. 1978 Edition of Library Checklist for the History of Science

In April 1978 The Committee on Undergraduate Education will issue a revised 1978 edition of its "Library Checklist of Books and Periodicals in the History of Science." Since the initial supply of the Checklist is exhausted, those who requested the Checklist after March 5 will receive a copy of the revised 1978 edition. The new edition includes additional recent books, notes the increased prices on many older books, and drops titles that are now out of print. Persons residing in the United States may receive a copy for 50¢ (mailing cost) in stamps or coin and an address label from Dr. Stephen G. Brush, Institute for Physical Science & Technology, University of Maryland, College Park, Maryland 20742. The Committee also requests suggestions of out-of-print titles that should be reprinted for use in undergraduate history of science courses.

ERRATUM

In "Scientific Society Involvement in Whistle-Blowing" in the January 1978 Newsletter, the employers of the engineers involved in the BART system case were erroneously identified. These engineers were employees of the BART management system. The Newsletter regrets any confusion that may have been caused by the misidentification.

II. MEETINGS CALENDAR

1-2 June 1978	The Canadian Society for History and Philosophy of Mathematics and the Canadian Society for History and Philosophy of Science, Joint Meeting; University of Western Ontario, London, Ontario, CANADA.
5-8 June 1978	National Computer Conference (AFIPS, ACM, DPMA); Anaheim Convention Center, Anaheim, California.
20-21 June 1978	AAAS Science and Public Policy Colloquium; Mayflower Hotel, Washington, D.C.
21-30 June 1978	Science Week at the New York Academy of Sciences, New York City; three international conferences; theme: "The Scientific Basis for the Public Health Control of Environmental Hazards."
12 August 1978	Symposium on Teaching Science and Environmental Writing: "The Journalism of Uncertainty," Association for Education in Journalism, Annual Meeting; Seattle, Washington.
14-18 August 1978	Conference on Critical Issues in the History of Technology; Hotel Roanoke, Roanoke, Virginia.
20-25 August 1978	AIBS, 29th Annual Meeting; The University of Georgia, Athens, Georgia.
26 Aug.-2 Sept. 1978	World Congress of Philosophy, Düsseldorf, GERMANY.
28 Aug.-1 Sept. 1978	American Psychological Association, Annual Convention; Toronto, Ontario, CANADA.
4-8 September 1978	Second Conference on the History and Philosophy of Science; Domus Galileana, Pisa, ITALY.
19-21 October 1978	SHOT, 21st Annual Meeting; Pittsburgh, Pennsylvania.
27-29 October 1978	History of Science Society, Annual Meeting; University of Wisconsin at Madison.
26-29 October 1978	Philosophy of Science Association, Sixth Bienniel Meeting; Jack Tar Hotel, San Francisco, California.
3-5 November 1978	Society for Social Studies of Science, Third Annual Meeting, Indiana University, Bloomington, Indiana.
11-15 January 1979	American Mathematical Society, Annual Meeting, Milwaukee, Wisconsin.

III. LEGISLATIVE REPORT: The U.S. House of Representatives and Recombinant DNA

Aaron Seidman
Recombinant DNA History Project
Massachusetts Institute of Technology
Cambridge, Mass. 02139

Although several bills to regulate recombinant DNA research were introduced into the Congress during 1977, no legislation has yet been passed.[1] One bill, H.R. 7897, was reported out of the Subcommittee on Health and the Environment of the Committee on Interstate and Foreign Commerce, but failed to emerge from the full committee before the end-of-the-year recess. Lobbying and negotiation during the Congressional recess produced a new bill, which was recently introduced in the House by Harley Staggers (D-W.Va.), Chairman of the Committee on Interstate and Foreign Commerce, and Paul G. Rogers (D-Fla.), Chairman of the Health and Environment subcommittee.[2] On 14 March 1978, this new bill (H.R. 11192) was marked up and voted out of committee. The bill is a "two-year interim control measure" that would, according to its sponsors, do the following:

> "(1) Require that the sections of the NIH guidelines... on Containment (Section II) and Experimental Guidelines (Section III) apply to all parties conducting recombinant DNA activities;
>
> "(2) Empower the Secretary of Health, Education and Welfare to promulgate administrative regulations, revise the Guidelines to reflect new scientific data, and exempt from the guidelines activities determined to present no significant risk to health or the environment or for specific risk assessment studies;
>
> "(3) Give inspection authority to the Secretary of HEW, and empower him to enforce the Guidelines, as appropriate, by (a) suspension of research grant funds, (b) a civil penalty ($5000) or (c) seeking an injunction through the courts;
>
> "(4) Preempt states or political subdivisions thereof from establishing or continuing in effect any requirement for the regulation of recombinant DNA activities. However, the Secretary would be authorized, upon application and after considering local conditions, to approve a state or local requirement if it is the same as, or more stringent than a Federal requirement and if the additional requirement is necessary to protect the health or the environment; and
>
> "(5) Establish a study commission to evaluate Federal policy on activities involving genetic manipulation as well as the long term applications of gene splicing technology."[3]

During the March 14 mark-up session, the Committee adopted several clarifying amendments but defeated those amendments intended to alter the substance of the bill. For example, Representative Edward J. Markey (D-Mass.) took exception to the provision of H.R. 11192 that allows the Secretary of HEW to exempt--by "order"--some rDNA activities from the regulations. Markey pointed out that unlike "regulations," which must be accompanied by public hearings, "orders" can be issued and implemented without such hearings. He therefore introduced an amendment to require that any exemption be by "regulation" rather than "order," but the amendment was defeated.

Also defeated were two amendments that would have weakened Federal preemption of local regulations. Rep. Barbara A. Mikulski (D-Md.) proposed that local ordinances controlling rDNA activity be allowed to stand unless the Secretary of HEW found them "not necessary for the protection of health or the environment," (thus, reversing the preemption provision in the current bill). An amendment offered by Rep. Marc L. Marks (R-Pa.) would have allowed local legislation that "is reasonable" (rather than "necessary") to protect the health and environment. Similarly, an amendment introduced by Rep. James M. Collins (R-Tex.), which would have required a warrant to search or inspect rDNA facilities, was also unsuccessful.

A report of the Committee's actions will be prepared to accompany the bill when it goes to the floor of the House. Rep. Olin E. Teague (D-Tex.), Chairman of the House Committee on Science and Technology, is expected to ask the Speaker for sequential referral of the bill to his Committee, which deals with research policy. If the Speaker accedes to Teague's request, the bill will most likely be assigned to the Subcommittee on Science, Research and Technology, chaired by Ray Thornton (D-Ark.)--the same subcommittee which held extensive hearings on rDNA last year.[4] In cases of sequential referral, House rules require a time limit to be placed on the second committee; it therefore seems probable that a bill to regulate recombinant DNA research will get to the floor of the House this year.

NOTES

1. See the January 1978 issue of this Newsletter, #22, pp. 30-32.

2. A similar bill has been offered in the Senate in the form of an amendment to S. 1217, which has already been reported to the full Senate.

3. Letter dated March 10, 1978, from Representatives Paul Rogers and Harley Staggers to members of the Committee on Interstate and Foreign Commerce.

4. See: Science Policy Implications of DNA Recombinant Molecule Research. Hearings before the Subcommittee on Science, Research and Technology of the Committee on Science and Technology, U.S. House of Representatives, 95th Congress, First Session (Washington, D.C.: U.S. Government Printing Office, 1977).

IV. PERSONAL COMMENTARY: Observations on Science, the Media, and the Public at the 1978 Meeting of the AAAS

Marcel Chotkowski La Follette

When this newsletter was first published in 1972 as the Newsletter on Public Conceptions of Science, the scientific community was greatly concerned about the apparent decline in public confidence in science and public understanding of science. By 1976, shifts in the roles and relationships of science and the public prompted a change in the publication's name to emphasize the ethical and social dimensions of science. This change recognized that it is not only the public's image of science, but also science's image of itself--its own direction, boundaries, and ethical structure--that is important. Echoes of this shifting concern could still be heard within the dialogue and discussion at the February 1978 meeting of the American Association for the Advancement of Science (AAAS).

Some of the recent changes within the AAAS have taken place without much public posturing. Interpretors for the deaf are given now neither explanation nor attention--skillful hands flip and dart like the heads of geese, grabbing words out of the air to articulate to the eye what cannot be interpreted by the ear. A political demonstration against nuclear power was allowed to wind through the large meeting hall, silently representing in sign and presence the pressure of communication from the public. That such a large (and in many ways conservative and non-cohesive) organization has become sensitive to the needs of handicapped members and to demands for formal expressions of public protest is in itself remarkable. But other less visible changes are taking place, shaped by the peculiar relationship between science and the press and continued pressure for the institutionalization of public participation in scientific decision-making and regulation. Here are some personal observations on the mechanisms and forces bringing about critical realignments in the relationship between scientists, journalists, and the public.

Media Expectations and Ethical Decision-Making

In his public lecture on scientific and political communication, Senator Mike McCormack (D-Wash.) encouraged scientists to take a "more aggressive and deliberate role" in communication with the public and with public officials--in the communication of not only facts and figures but also the political and social ramifications of science, the interpretations of evidence which pertain to public policy.[1] Yet calls for scientific "outreach" are empty gestures without the cooperation and understanding of the mass media. The personal visit or letter to a member of Congress is forceful but ineffective if unsupported by evidence that the opinions are widely shared in the scientific community. As Wilbur Schramm has noted:

> A reasonable hypothesis is that the most powerful effect of the mass media on public knowledge... is the ability of the media to focus public attention on certain problems, persons, or issues at a given time.[2]

The scientific community has seen this effect in force as the media have focused, in turn, on "The Environment," "Energy," and "recombinant DNA," and through a host of other issues of public concern. In essence, the scientific community now relies frequently on the mass media to "get the message out" to the public and to policy makers.

There is awesome power inherent in such reliance, and perhaps one of the things I heard at the AAAS meeting was the media representatives flexing their muscles. In one session devoted to discussion of the public communication of science,[3] the criticism was dispensed by the reporters on the panel, rather than directed to them, as is more usual at such scientific meetings. Journalists argued forcefully for increased cooperation from scientists and complained at length of the problems they face in reporting on science.

Are these journalists merely reflecting decreasing public interest in news about science? Peter Gwynne, Science Editor of Newsweek, asserted that decline in public confidence in science directly affects the media coverage. He stated that his recent check of the back files of Newsweek revealed 50% fewer science stories in 1977 than in the preceding ten years;[4] Gwynne attributed this decline to (1) the diminished U.S. space program, a popular topic for science writers in the 1950's and 1960's; (2) increased science content of the "regular" news; and (3) the fact that there is less "solid science" to write about, citing the AAAS meeting as an example. Indeed, there has been a decline in the "demonstration" science practiced by NASA during the space missions of the 1960's and early 1970's. Those events were excellent media topics--not too complex, highly visual, incorporating heroes and the conquest of new frontiers and the excitement of a "race" and a myriad of other prime-time entertainment themes. Today's hottest science topics are often in the fields of biology, particularly genetics, and involve the miniscule, the not-so-easily visualized, and the terribly complex. "Pollutants" and "carcinogens" are common terms in American vocabulary, but television news cannot show us a pollutant, only perhaps a polluter; magazines can list known carcinogens, but there are few visuals and few simple explanations for the situations which may activate carcinogenicity. Nevertheless, the science content of regular news stories has increased--Gwynne was undoubtedly counting only those stories clearly categorized as "science." The Energy Bill discussions, the Alaska Pipeline, nuclear power protests, chemical spillages, contaminated water supplies, have all been "Page One" news stories in recent years and all contain many components of information about scientific research and the scientific community.

One member of the audience felt sufficiently troubled by statements made by the panelists (all media representatives) to point out to them the difference between a "fact" story and a "policy" story, in which often the most interesting (and important) aspect is the inability of the scientists to give the correct answer, to provide overwhelming evidence for one decision or another. Which leads us back to Gwynne's third point regarding the lack of "hard science" stories at the AAAS meeting. This same point was made--most aggressively--by Jules Bergman of ABC-TV, who labelled the AAAS meeting "a joke" and complained that the meeting lacked "hard news." Where does such criticism leave the scientific community? It has only recently been persuaded to be more attentive to the ethical and social implications and consequences of research, to be more cognizant of the eventual uses of discoveries and of the nature of the economic support structure of science. Now journalists criticize scientific meetings for a "lack of hard news," for

attending to the very social or ethical issues (regarded by the journalists as "soft news") that the scientific organizations have only recently been convinced to discuss. Such criticism by the media contains an implied threat of diminished coverage of scientific meetings and press conferences, a threat which hits a sensitive nerve in a community that believes that good press relations are essential to its delicate economic and philosophical support structure.[5] What might be the effect on the scientific community of prolonged and strongly stated criticism of this type?

Bergman may, of course, have been intentionally stirring up discussion. Pointing out to the journalists that science is not "a sure thing," Bergman insisted, "it's about time, gentlemen, that we stop telling people that it is." This lack of surety increases the ethical questions that may arise in the relationship between scientists and reporters. George Alexander, Science Editor of The Los Angeles Times, described the effect on California reporters of constant improvement of seismological disturbance detection and prediction techniques. In California, premature predictions of earthquakes could have direct social impacts; the statement which to a knowledgeable seismologist seems a highly conservative estimate of the very low probability of a disturbance might trigger panic in a public predisposed to believe in the authority of science and unfamiliar with the meaning of statistical estimates. Alexander feels that scientists, especially in areas such as seismology or genetic research, cannot go back to the "old ways" of dealing with the media, first because of the potential impact of discoveries in those fields but also because of increased public participation, interest, and interference in research. Scientists can now expect to be followed at all stages of their work by both reporters and citizen's groups. To reporters like Alexander and Bergman, scientific research must be visible and scientists must willingly accept this visibility and public scrutiny.

Several panelists argued that scientists should be willing to share their data with reporters at earlier stages of the research, should be willing to violate the traditional "Ingelfinger Rule"[6] and release data to the media before it is formally communicated to colleagues. Comments such as these by respected and influential reporters only serve to highlight other ethical issues in science-press relations. On one side, reporters attempt to persuade scientists to release results earlier and earlier. On the other side, the scientific community urges caution regarding premature dissemination of data, stresses the need for peer review of results, and, in many fields, penalizes the individual who publishes in the press before publishing in the journal.[7]

At the same time, pressures from within the scientific community call for increased awareness of implications, and the public demands increased accountability, as well as reliable expert advice. In press relationships, the scientist must reconcile ethical conflicts concerning the harm or benefit to society of the early release of research results.

Ethical decisions may also confront the reporter seeking scientific information. A desire to adhere to the informally adopted codes of ethics regarding journalistic objectivity may conflict with the classic symbiotic relationship that can develop between reporter and source.[8] Identification with the scientist is a chronic problem for the science reporter--who gradually faces choices between adherence to the ethical standards of science or of his own profession. The reporter may begin to defend, rather than report on or investigate, science.

As a specialist, however, he or she cannot easily change "beats" in order to regain objectivity and, furthermore, the lack of objectivity may not be readily apparent to either bosses or readers, who may be equally unfamiliar with the institution of science.

Media Coverage of the Regulation of Scientific Research

One of the issues which drew reporters to the AAAS meeting this year was the continued debate over recombinant DNA research (rDNA). The amount and intensity of the rDNA press coverage is largely due to the early interaction of concerned scientists with the media, and to the highly publicized soul-searching and early public posturing regarding the idea of self-regulation. In the instance of a self-imposed moratorium, self-regulation of research was carried out in the public light. The scientific community represented by the AAAS is now being asked to institutionalize expressions of public concern, to strike an acceptable balance between maintaining control over its own interests and encouraging public input. How the media describe both the attitudes of the scientific community toward public scrutiny and the process of scientific decision-making--the necessary trade-offs as well as the bases for particular decisions--could directly affect the patience, expectations, or demands of the non-scientific public.

The Sigma Delta Chi Code of Ethics for journalists states that: "The public's right to know of events of public importance and interest is the overriding mission of the mass media. The purpose of distributing news and enlightened opinion is to serve the general welfare." However, in some instances, publication of a result or prediction may provoke false expectations, or unwarranted pessimism, or even panic. In the seismologist's prediction example cited by George Alexander, the public's right to know could well conflict with the public safety. How scientists and reporters resolve such ethical conflicts in each encounter will undoubtedly affect not only the scientific community and science journalism but may have profound and less predictable effects on public attitudes toward science.

NOTES

1. Mike McCormack, "Scientific and Political Communication: Exorcising Maxwell's Demon," Public Lecture, 144th AAAS Meeting, Washington, D.C., 13 February 1978.

2. Wilbur Schramm, Men, Messages, and Media (1973), p. 261, cited in John L. Hulteng, The Messenger's Motives: Ethical Problems of the News Media (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1976), p. 209.

3. "New Trends in Interpreting Science to the Public," 144th AAAS Meeting, Washington, D.C., 14 February 1978.

4. George Alexander, of the Los Angeles Times, at the same AAAS session (Note 3) reported that his check of the Times files showed an increase in both the number and length of stories on science.

5. For description of public relations efforts by the scientific community, see Daniel Greenberg, "Let's Hear It For Science," Columbia Journalism Review, (July/August 1974), 16-23.

6. See Barbara J. Culliton, "Dual Publication: 'Ingelfinger Rule' Debated by Scientists and Press," Science 176 (30 June 1972), 1403-1405.

7. For example, Philip Handler, in a major address to the AAAS meeting, pleaded with his audience to refrain from early publication of results such as the alleged carcinogenicity of a substance until all data is assembled.

8. Hulteng, op. cit. (Note 2), 83-84.

COMING IN THE JUNE ISSUE...

"Scientists and the Public Interest, 1945-46," by Alice Kimball Smith and "Changing Dimensions of the Scientific Movement," by Dorothy Nelkin, with Commentaries by Peter Buck and Daniel Kevles.

V. OTA LOOKS AT EMERGING TECHNOLOGIES

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Background

The Office of Technology Assessment (OTA) "Early Warning" planning project (internally referred to as Emerging Technologies) was initiated in the fall of 1976. At that time, OTA had been in operation for about two and one-half years and had undertaken more than forty projects in seven program areas, largely in response to the immediate needs and requests of the committees of Congress. The Emerging Technologies project will complement that near-term orientation and will attempt to determine how the horizon for assessment activities might be further extended into the future and how greater emphasis might be given to "early warning" of emerging technologies not yet of legislative concern.

Two sets of questions have guided the project's early stages. First, what methods exist for identifying which candidate new technologies are likely to emerge in sufficient strength to have a sizable potential impact on the social, economic and/or environmental fabric of the country? Second, while much attention is now being given to the effects of technology upon society, little has been given to the influence of society upon technology. How do social attitudes and values result in a changed role for technology within society (including decreasing resort to technological solutions to major problems)?

A literature search and interviews with experts revealed a sizable discrepancy between the importance attributed to the influence of society upon technology and the research which has actually been undertaken. For example, the National Science Board stated in 1976 that scientific research is in a period of severe stress and reported that nearly all problems confronting the scientific community are due, at least in part, to changed public attitudes towards science and technology. From the viewpoint of the 600 scientists and others in policy-making positions surveyed by the Science Board, loss of public confidence was reported to be a cause of deep concern. Despite such expressed concern, there has not been a comprehensive national poll of public attitudes toward science for twenty years. From time to time, specific polls or questions within general surveys have attempted to measure public confidence in science and scientists,[1] but the meaning of much of these data are unclear, particularly because of uncertainty over whether and how the public distinguishes between science and technology. Neither limited surveys nor other more indirect methods of assessing public attitudes toward technology have adequately answered the questions raised above.

Joint OTA/Aspen Institute Workshop

A one-week workshop on Technology and Social Change,[2] jointly sponsored by OTA and the Aspen Institute for Humanistic Studies, provided a framework for discussion of the alternative actions that might be taken by OTA in structuring

further inquiry. Workshop participants largely agreed that Congress would greatly benefit from better information on the relationship between the development of new technologies and changing social attitudes, values, and behavior in the United States and elsewhere. Improvements in the ability to identify those technologies most likely to be widely deployed and increased knowledge about the distribution of conventional and new values and behaviors could help to identify and assess those issues and consequences likely to surround the introduction of new technologies and the continued use of established technologies. Workshop participants also emphasized that any OTA effort dedicated to investigation of the relationship between technology and social change should be programmatic, with assured funding for several years and closely interlocking project parts.

Plans For Project Activities in FY 1978-79

The Emerging Technologies project will follow two approaches in an attempt to define the relationships between technology and society and, hence, to provide early warning of emerging issues associated with technology and, if possible, of technologies per se. In an approach closely tied to ongoing OTA programs, the project will provide research information on emerging social trends and their implications, methods for identifying and measuring social change, and sources of further information, both through case studies illustrating how such information could be used in a hypothetical assessment to develop policy options and through other communications describing related research in this area.

For selected OTA assessments, the project will formulate an investigation of how changing attitudes/values/behaviors could affect the emergence and/or deployment of the particular technologies studied in the assessment and identify other social factors that should be considered in order to characterize policy options for the Congress.

Development of a Data Base on the Relationship Between Technology and Society Through Small Independent Pilot Studies

In the preceding approach, the technologies under study will probably be relatively mature and public attitudes/values/behaviors will be limited to those most relevant to those technologies. This approach can be characterized as relatively near-term. In a second, more long-range approach, one or two pilot studies will focus on immature technologies and on attitudes and behaviors which may currently exist in only small percentages of the general population.

To illustrate this latter approach, let us describe a pilot study on the current U.S. trend toward simpler living. This trend has been named "Voluntary Simplicity" (VS) by researchers at the Stanford Research Institute (SRI):

> The essence of voluntary simplicity is living in a way that is outwardly simple and inwardly rich. This way of life embraces frugality of consumption, a strong sense of environmental urgency, a desire to return to living and working environments which are of more human scale, and an intention to realize our higher human potential--both psychological and spiritual--in community with others. The driving forces behind voluntary simplicity range from acutely personal concerns to critical national problems.

> The appeal of simple living appears to be extraordinarily widespread, even gathering sympathy from among those who are not presently attempting to simplify their own life patterns.[3]

SRI estimates that 3% of the adult population (4 to 5 million adults) currently live a life of voluntary simplicity characterized by "organic gardening, recycling, natural foods, simple clothing, biking to work, back packing on vacations, family orientation, engaging in meditation or other growth processes." The Institute estimates that another 8 to 10 million adults follow some but not all the tenets of voluntary simplicity and that between one-third and one-half of the total adult population do not practice VS but are sympathetic toward it.[4]

While the SRI data are indirect, polls provide more direct data supporting a VS movement. Thus, in a 1975 poll, Louis Harris Associates found that by 79% to 17%, people favor emphasizing "teaching people how to live more with basic essentials" than "reaching higher standards of living."[5] By 63% to 29%, they opt for "learning to appreciate human values more than material values" as compared to "finding ways to create more jobs for producing more goods." Louis Harris found that "92% of Americans are willing to eliminate annual model changes in automobiles" and 73% are willing to wear old clothes (even if they shine) until they wear out." They concluded that "when the alternative is posed between changing our life style to have less consumption of physical goods, on one hand, and enduring the risks of continuing inflation and unemployment on the other, by 77% to 8%, the American people opt for a change in life style." Other evidence of support for VS comes from the large sales of books like Small is Beautiful, The Whole Earth Catalog, and Limits to Growth.

Aside from the potential impact of a widespread VS movement on technology, there is another reason for careful study of the emergence of VS. This is the serious concern on the part of a number of governments and institutions over how to avoid a catastrophic collision between growing consumption of resources and the limits on those resources. This has led to a number of reports; for example, A Blueprint for Survival (Great Britain), the GAMMA Report on The Conserver Society: A Blueprint for the Future (Canada), and Mankind at the Turning Point (Club of Rome). These reports suggest adoption of many of the principles of VS as a way for the industrialized nations to achieve stability in a growth-limited world.[6]

While the above suggest the potential importance of a widespread VS movement, there are many areas in which further information is essential to adequate evaluation:

- What does the term "Voluntary Simplicity" mean to different people? It is not clear that everyone has the Stanford Research Institute definition in mind when they speak of VS (and the definition used will of course affect the estimates of the numbers of people practicing VS). VS could mean a lifestyle characterized by little dependence on material goods but sizable expenditures for services or travel. The resource requirements of this lifestyle could be as high or higher than for a lifestyle characterized by high consumption of material goods. On the other hand, some people may use the term Voluntary Simplicity only to designate

a lifestyle characterized by little expenditure for goods or services or travel.

- Depending on the definition of Voluntary Simplicity, how many people are actually practicing VS or different types of VS? The SRI data are based on very indirect evidence, and the Harris poll results utilize statements of what people say they prefer (which may be quite different from what they want for themselves or what they actually do).

- What are the implications of VS for society in general and for technology in particular? What kinds of technology do those practicing VS (or different kinds of VS) use? How does VS relate to appropriate technology?

The pilot study described above is illustrative only. The Office of Technology Assessment would be interested in hearing from other groups who are investigating the relationships between technology and society, especially those whose interest lies in policy analysis and/or in using data on social change to help identify emerging technologies or emerging issues likely to be associated with technology. Communications should be addressed to the author at the Office of Technology Assessment, U.S. Congress, Washington, D.C., 20510.

NOTES

1. See, for example, Todd La Porte and Daniel Metlay, "Public Attitudes Toward Present and Future Technologies: Satisfactions and Apprehensions," Social Studies of Science, Vol. 5 (November 1975), 373-398.

2. The workshop was chaired by Donald Michael, Program Director of the Institute for Social Research, University of Michigan. Panelists included representatives of the academic community, private foundations, and industry.

3. Duane Elgin and Arnold Mitchell, "Voluntary Simplicity," CoEvolution Quarterly (Summer 1977).

4. Ibid.

5. Carter Henderson, "Voluntary Simplicity," New Age (Summer 1977).

6. Ibid.

VI. THE RIGHT TO KNOW AND THE RIGHT TO CREATE*

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The vehemence of the language and the anger of the disputants in the recent public debate over recombinant DNA research suggest that the issue has touched a nerve, not simply because it raises a new problem--the prospect of creating new forms of life--but because it reopens a very old wound in Western history--the quarrel over the right to know and the right to create.

The Right to Know

Advocates of recombinant DNA research usually resist limitations on the research as an interference with the right to know, perhaps partially because restrictions awaken memories of Lysenkoism and the trial of Galileo. The Western intellectual tradition grows out of the dual conviction that knowledge is an intrinsic good and curiosity is a virtue, yet they were not always so esteemed, even in the West. The classical theological tradition, for example, once rejected an unqualified right to know. St. Augustine of Hippo numbered amongst the cardinal sins "the lust of the eyes," by which he meant not only the thirst for theater and spectacle, but also aimless curiosity. St. Bernard of the twelfth century, in his treatise On Humility, advised the pious monk to keep his eyes cast down on the ground before him to avoid the sin of curiosity. Uncurbed curiosity distracts the soul from its proper concentration on God and its own poverty before him. Curiosity is not only distracting but dangerous if it leads the pious into the snares of false doctrine. The church, in the case of Galileo, challenged the right to know on theological grounds--wrongly and to its own embarrassment. The episode stands as unsavory precedent and symbol of the evils that result when the religious community curbs the right to know. Its prohibitions, moreover, do not stem from that humility which St. Bernard sought to defend but from an arrogance that would impose humiliation on others.

The church, of course, had resources within its own intellectual life to reach other conclusions. Indeed, St. Thomas once gave theological warrant for curiosity when he observed that to do justice to God one must do justice to the world. To prove and explore the world does not distract from the theological enterprise; quite the contrary, it enriches it. To the degree that the believer explores the wonders of the world, he has better access to the glory of God. With a single stroke, St. Thomas provided theological license and warrant for the modern university--its teaching function and its research life.

Knowing and Creating

St. Thomas drew a sharp distinction between the activities of knowing and creating, placing knowledge primarily in the service of adoration. But in the late sixteenth and early seventeenth centuries Giordano Bruno and Francis Bacon

*Based on a presentation to "Science and the Public Interest: Recombinant DNA Research--A Public Forum," Indiana University, November 1977, Bloomington, Indiana.

linked knowledge with dominion and power. They celebrated not only man's power for knowledge, but the power he acquired through knowledge. Bruno wrote:

> The gods have given man intelligence and hands, and have made him in their image, endowing him with a capacity superior to other animals. This capacity consists not only in the power to work in accordance with nature and the usual course of things... but beyond that... to the end that by fashioning, or [having] the power to fashion, other natures, other courses, other orders by means of his intelligence [and] with that freedom without which his resemblance to the deity would not exist, he might in the end make himself god of the earth.[1]

Bacon, from this point forward (about 1583-85), felt that "a new order of events was at hand, the specific quality of which would consist no longer in a mere imitation of nature but in her domination by man."[2] Inasmuch as knowledge is power, the virtue of curiosity leads to virtuosity--the capacity to work great changes in nature--to produce magnalia naturae to match magnalia dei.

Creation and Benefit

In Bacon's view, the power that flowed from knowledge should redound to the benefit of humanity. By linking knowledge, power and universal benefit, he thus broke with the magicians and alchemists before him, to whom, nonetheless, he owed a great deal. The wizards and magicians linked knowledge with power, but they were tempted to think in proprietary terms about that knowledge. Bacon complained that they transformed nature, but simply to arouse wonder rather than to serve some larger human purpose: they were vain-glorious and self-seeking; they believed themselves to belong to a privileged class of illuminati, hermetically sealed off from the rest of the human race. Thus Bacon insisted on adding the virtue of philanthropy to those of curiosity and virtuosity. Benjamin Farrington has written that the new knowledge gained thereby was to be

> .... fed back into the industrial life of the nation. This was no small task, as Bacon well knew. It was King's business. It should not be left to the monk in the cloister, the alchemist's furnace, the rich nobleman's curiosity or the workshop of the artisan. It required to be taken under the wing of the government.... For it was not simply an addition to knowledge but the inauguration of a new way of life, the great instauration of man's dominion over the universe.[3]

Bacon, take note, spoke of man's dominion over the universe, not of the dominion of some men over the universe, or of some men over other men, or of one generation over future generations. This universalism distinguished the scientist from the parochial magician, the wayside wizard, and the hermetical alchemist. The enlargement of powers through science should not be construed as the limited triumph of some, but the enhancement of the many. To this very day, we hold to this sense of universal participation in knowledge and power--"One small step for man, a giant step for mankind." And to this day, when we hear talk about the enlargement of human powers through science we are inclined to neglect the questions of whose power over what, for whom, at what price, and over whom.

We are inclined to pass over these pointed questions and assume that the power acquired through knowledge eventually runs off into a kind of reservoir at the general disposition of the human race.

The Debate over Recombinant DNA Research

Keeping in mind these background distinctions among knowledge, power, and benefit for humankind and keeping in mind the way in which these distinctions tend to dissolve into one another, I would like to make a few observations about the current debate over recombinant DNA research.

When advocates for the research sell the enterprise to the community at large, they rely on the Baconian links between knowledge, power, and boon. They hold out the prospects that the research will lead to an understanding and perhaps control and cure of a variety of cancers and inherited diseases (such as diabetes and hemophilia), to the production of inexpensive new vaccines and plants that draw their nitrogen directly from the air rather than from costly fertilizers, and to a vastly improved knowledge of the genetics of all plants and animals, and eventually humankind. When, however, opponents worry about specific adverse consequences of recombinant DNA technology, advocates often retreat and appeal to the right to know as if the right has no intrinsic connection in this case with a further right to create. They ignore the fact that recombinant DNA research binds together knowledge and creation more inextricably than they have been linked before. When one engages in this research, one is not simply claiming the right to know or the right to know in order to create socially useful products, but claiming the right to create in order to know. The new ingredient in the discussion is that creation of new forms of life is a condition of this knowledge. Creation and manufacture are not simply later results; in this case, creation of unprecedented forms of life precedes discovery. Without these novel forms--the subjects of investigation and manipulation--the research could not go forward. Here, the claimed right to know directly entails the right to create.

If this analysis is correct, then social control over rDNA research would not be without its own natural limits. Regulations would not curtail the right to know, in and of itself, but only the right to create in order to know. The argument for federal or local regulation would not justify a limitless intrusion on the right to know but a restriction on that right only as it is linked with the production of new forms whose deleterious consequences may possibly be great but cannot be fully assessed in advance.

Put another way, the right to know is a fundamental right, but not absolute, certainly not when the condition of its exercise is the creation of forms and technologies with potentially destructive consequences for others. This limitation on the right to know is analagous to the limitation on the exercise of religious freedom. Because religious freedom is a fundamental right, a Jehovah's Witness is free to hold to his particular beliefs concerning human blood and to refuse a blood transfusion for himself, despite the fact that this refusal may result in self-injury. But religious freedom is not an absolute right that extends beyond belief into behavior that has consequences for others. The courts determined this when they denied to Jehovah's Witnesses the right to refuse the administration of blood transfusions to their children. One has the right to be a martyr to one's own beliefs but not a right to make martyrs of one's own children.

Similarly, the academic and research community has the right to know but not the absolute right to know when the terms and conditions of that knowledge may impose the potential of martyrdom on others. This consideration led recently to the development of guidelines for experimentation on human subjects, including the requirement of informed consent. And it has provoked concern about recombinant DNA research and stimulated the development of guidelines for its proper conduct.

At the same time, this carefully delimited warrant for community review of the scientific enterprise should allay scientists' fears that they face ever-increasing restrictions on the right to know. I find it hard to respond to the alarums of those who cry: "Today the geneticists, tomorrow the linguists." In this case, the argument based on the thin edge of the wedge cuts only so deep. It subjects the right to know to review only under certain conditions of its exercise. Proceeding then, on the principle that the right to know/create is not absolute, we need to explore two moral questions:

1) By what criteria should decisions be made? and
2) Who has the right to make decisions on possible restrictions on recombinant DNA research?

One technique commonly applied in decision making today is risk-benefit analysis, a methodology derived from a generally utilitarian perspective. To apply risk-benefit analysis to the question of recombinant DNA research, one assigns a value to each benefit, calculates the total of all possible benefits to health and life, and then strikes off a surplus or deficit sheet against all possible harms, both short and long term. Scrupulously applied, this procedure would give a special weighted negative value to harms, out of respect for the medical-moral principle: "do no harm." Recombinant DNA research would then be justified if the benefits significantly outweighed the harms.

Several considerations should be kept in mind in applying risk-benefit analysis to recombinant DNA research. 1) The very phrase "risk-benefit" is misleading. "Risk" implies the mere possibility or probability of harms; "benefit" seems to describe virtually certain payoffs. The words are not balanced opposites. It would be more accurate to talk about either risk-hope analysis (both words would then clearly traffic in possibilities) or harm-benefit analysis (both words would then refer to assured outcomes). The phrase "risk-benefit" analysis fails to achieve this symmetry. It loads the rhetoric in favor of those who want to go ahead with the research. This loading has occurred in specific cases. In a very slippery paragraph, the report of the Princeton University Committee on Biohazardous Research included answers to the problem of cancer in its list of virtually certain medical results of the research.[4] Even James Watson, an outspoken advocate of rDNA research, concedes that it may take 100 years before such research will yield results for cancer treatment. It would have been better for the Princeton Committee to talk about hopes rather than benefits.

2) The application of risk-benefit analysis to recombinant DNA research is further complicated by uncertainty, a particularly awkward situation for an analytical procedure seeking to substitute methodical calculation for heedless stumbling into the future. First, it is difficult to assign a precise social value to specific benefits and harms. It would be morally and politically unwise to reserve the task of assessment to scientists alone; scientists are in no better position than lay people to make final judgments about these matters. Second, it

is difficult to arrive at plausible estimates of probability for risks and hopes, although scientists are in a better position than lay people to make these estimates. On the whole, I am inclined to accept the testimony of scientists who argue that risks associated with rDNA research are rather minimal, probably less than in other areas of research. Still, risks are there, and not only because all scientific experimentation contains some uncertainty. (Advocates argue that all experimentation is a venture into the unknown--that there would be no need to experiment if everything were known in advance of the research protocol. This observation is reassuring, but only to a degree). The element of uncertainty is magnified in a situation where the very matter of the experiment is not something already in the world, with its own natural history, but unprecedented forms of life which the experimenter has brought into being. Recombinant DNA research thus presents special problems for attaining certainty in advance of investigation.

Long range industrial applications generate additional uncertainties. Evidence of whether a given technology is, in fact, a plus or a minus may not be forthcoming until one is already committed to its widespread employment. Our experience with the development of insecticides and detergents is a case in point. What appears at first glance to be self-evident boon can prove eventually in mass production and use to be bane. When one reads the tantalizing news that new organisms can be manufactured to eat up oil spills, one worries: who will eat up the eaters? The right to know should not flow smoothly and continuously into the right to manufacture without assessing the ecological risks and costs of the technologies in their application. Harvard University Professor Walter Gilbert argued at a recent conference[5] that these technological assessments are part of the subsequent responsibility of agencies such as the Food and Drug Administration and should not be used as arguments against the basic research itself. Well and good. But if industrial applications are cited as benefits that justify the basic research, then the calculation must also include the risks attendant to their widespread use. Discussion cannot be limited to the minimal risks of the original basic laboratory research and then expanded to include any and all useful technologies that might result. If you eat lunch, you have to pay the full cost and not pretend that the opening tip to the maître d' covers the bill.

3) To justify the basic research on the basis of risk-benefit analysis, one must do more than prepare a profit-loss sheet on recombinant DNA research alone. There must also be evidence that the proffered benefits--the prevention or cure of cancer, the control of diabetes or oil spills, etc.--cannot be more satisfactorily attained through other means with fewer risks. I have not often seen advocates of the research carry through with this comparative analysis. Indeed, Mark Ptashne of Harvard University's Biological Laboratories exhibits an impatience with such a challenge when he criticizes his colleague George Wald:

> Wald has added a series of diversions, the relevancy of which I cannot determine. It is no news to most of us that smoking causes lung cancer, but what are we to make of the admonition: 'If one were really concerned about cancer, there is the obvious place to attack it (i.e., smoking) with sure and immediate results.' Does Wald mean to imply that those who work on DNA are not really concerned about cancer?[6]

Professor Ptashne misses the point. If an eventual understanding and potential treatment of cancer is claimed as a benefit of recombinant DNA research, then it is not irrelevant to discuss other perhaps more direct and less risky ways of attaining the same benefit.

4) Finally, exclusive appeal to risk-benefit analysis deals too lightly with questions of social injustice. The criterion works better when applied to the problems of a single individual. A conscientious physician, for example, in assessing alternative therapies, totes up the risks and benefits for various treatments and decides whether, all things considered, a given line of treatment is the best course to follow for the patient. The risks and benefits apply to the same person. But society is a community of persons, not a single organism. Risks and benefits do not shower upon the population equally. A given technology may be boon for some and bane for others. Some advocates of recombinant DNA research seek to downplay this problem of distributive justice. They point out that in other areas risks fall unequally on populations; nevertheless, we incur them for social good. Bridges, high rises, and dams are built for the general welfare despite the fact that workers inevitably die in the course of their construction. The analogy, of course, is inexact. Workers make a decision to take their jobs; they are paid for their work; and their families are compensated in the case of accidents. Such workers are more like scientists and technicians in a laboratory than adjacent and unconsenting populations at risk either in recombinant DNA research or in the deployment of its consequent technologies. An appeal to the overall surplus of benefit over risk does not in and of itself solve the problem of special populations at risk. The principle of beneficence must be supplemented by a principle of justice with respect to the distribution of harms and goods.

But an abstract principle of justice is not enough. Democracy consists of a process as well as principles. If risks and benefits fall unequally on the populace, then one must respect the rights of citizens to participate through their representatives in the decision-making process. If we deny them participation, we wrong them. Such wrong is a different order of moral problem than injury or harm, possessing its own special kind of certainty. Indeed, our likelihood of harming unconsulted populations at risk is only possible or probable, depending on the odds; when we deny them the right to participate in decisions that affect their destiny, the likelihood of wronging them is virtually certain.

Respect for justice thus leads us to a last question: who shall decide whether and how we shall pursue recombinant DNA research? Scientists? Private industry? Local governments? The Federal government? Cause-oriented advocates or protestors? This is a subject which I can do no more than acknowledge here.

I do not see how these issues can be left to private parties alone--whether they represent commercial, academic, scientific, or ideological interests. It is to the credit of the scientific community that scientists themselves raised the issue for public discussion. I cannot agree, however, with James Watson who, in retrospect, feels that scientists, himself included, made a major tactical error in permitting the question of this research to become a public issue. When scientists feel that the only lesson to be learned from this controversy is to keep things quiet and private, they retreat to the world of wizards and magicians, who think in proprietary terms about their knowledge and the dominion and power it bestows and who act as though only their curiosity and virtuosity are at issue.

The giant steps forward of scientists do not make them the representatives of humankind. They have been neither educated for it nor elected to it. I cannot, therefore, view with alarm the surfacing of this problem in the public domain or the development of NIH guidelines to cover federally-supported research, nor can I resent eventual legislative provision for orderly review of both federally-supported and privately-sponsored research and regulations that have some teeth in them.

It should be clear from the foregoing that I am not in favor of a green light. At the same time, I am not in favor of a red light. I am an amber man.

A permanent red light against basic recombinant research does not seem to be warranted on either religious or moral grounds. An absolute prohibition would assume that to explore nature is to profane it. To be sure, such profanation and abuse can and does take place, especially when there are messianic notions of what the research will accomplish. To probe and explore nature (and to create new forms) can stir that wonder and respect to which Aquinas referred and, sometimes, can even provoke that humility which Bernard of Clairvaux so highly valued. The possible abuse of a human talent does not argue for an absolute prohibition against its use.

On moral grounds, I am also unable to argue for a permanent red light against the basic research. A total prohibition does not seem to this amateur to be warranted by the scientific information to date. The risks seem very low if the aforementioned precautions, which I would endorse, are taken. Those risks, however, may rise rapidly with widespread use. I am disturbed, therefore, by a very careless appeal to a harm-benefit analysis that exposes only the risks of basic research but not the risks entailed in the technological and industrial exploitation of that research. When scientists obscure the price tag for the goods which they themselves dangle before the public, they help to create that atmosphere of heedlessness from which they themselves as well as their fellow citizens may one day suffer. The uncertainty attendant to the basic research invites some measure of caution. This caution itself may have exemplary force as the society proceeds to subsequent assessment of industrial applications. We cannot bemoan wanton and runaway applications if we have not laid our moral foundations carefully.

NOTES

1. Benjamin Farrington, The Philosophy of Francis Bacon (Liverpool: Liverpool University Press, 1964), p. 27.

2. Ibid., p. 28.

3. Ibid., p. 54.

4. Recommendations for the Conduct of Research with Biohazardous Materials at Princeton University, A Report to the President of Princeton University from the University Research Board based on the deliberations of its subcommittee on Biohazardous Research, ch, Prof. Robert M. May, p. 10.

5. "Science and the Public Interest: Recombinant DNA Research--A Public Forum," Indiana University, November 10-12, 1977, Bloomington, Indiana.

6. Mark Ptashne, "The Defense Doesn't Rest," Genetic Engineering, Human Genetics, and Cell Biology; Recombinant DNA Research, Supplemental Report, prepared for the Subcommittee on Science, Research, and Technology, U.S. House of Representatives (Washington, D.C.: U.S. Government Printing Office, 1976), pp. 246-47.

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In Fall 1978, a comprehensive, updated Bibliography on Law and Science will be published as a softcover monograph by the Newsletter on Science, Technology & Human Values. Compiled under the direction of Morris Cohen, Harvard University School of Law, the publication will provide extensive references to the Law-Science literature 1965-1978 and selected references to earlier works of particular significance. Readers who wish to receive early notice of publication should contact the Newsletter editors.

VII. ADDITIONS TO THE GENERAL BIBLIOGRAPHY

American Association for the Advancement of Science (AAAS). The Proceedings of the Conference on National Energy Policy. Washington, D.C.: AAAS, 1978.

Proceedings of a one-day conference held in May 1977 in an effort to bring together leaders in government, industry and academia for the purpose of discussion of President Carter's National Energy Plan. Speakers included Sen. Henry M. Jackson, Philip H. Abelson, Charles Zraket, Chauncey Starr and Emilio Q. Daddario. Special consideration was given during the forum to international and economic questions and to issues of government regulation and responsibility.

AAAS Committee on Scientific Freedom and Responsibility (CSFR). 1977 Annual Report. Washington, D.C.: AAAS, 1978.

This report presents highlights of the activities of the six subcommittees of the CSFR--focusing on infringements of scientific freedom at home and abroad, on the boundaries of scientific freedom, on professional and social responsibilities, on freedom and responsibility in science teaching, and on government funding for scientific responsibility. Four papers (by H. Bentley Glass, John Edsall, Harold P. Green, and Frank von Hippel, respectively) presented at the 1977 CSFR symposium are reprinted in their entirety. The booklet also includes a selected bibliography and list of committee documents. Copies may be obtained from the AAAS (1515 Massachusetts Avenue, N.W., Washington, D.C. 20005) for $2.00.

American Physical Society. Women in Physics. New York: American Physical Society, 1977.

A 31-page booklet which describes, for women planning careers in physics, the various areas of physics research and the characteristics of theoretical and experimental research. Additional sections address such topics as job discrimination and the combination of marriage and career. Single copy is free; additional or multiple copies are 50¢ each, prepaid (American Physical Society, Committee on the Status of Women, 335 East 45th Street, New York, New York 10017).

Ames, Mary E. Outcome Uncertain--Science and the Political Process. Washington, D.C.: Communications Press, Inc., April 1978.

This book attempts to relate science to politics, ethics, and social science through case histories and through analysis of changing public attitudes toward science and technology.

Annas, George J. "Legalizing Laetrile for the Terminally Ill." The Hastings Center Report 7, December 1977: 19-20.

Focuses on one law suit and the solution to the Laetrile problem it proposes: making Laetrile legally available only to terminally ill patients.

Appropriate Technology and Agriculture in the United States. Washington, D.C.: U.S. Government Printing Office, 1977. $1.30; Stock number 038-000-00323-2.

Surveys the concerns, goals, and activities of persons in the field of appropriate technology (AT) and explores the factors that inhibit the development and application of their innovations. Includes an assessment of the policy implications of AT in relation to the U.S. economy.

Beauchamp, Tom L. and LeRoy Walters, eds. Contemporary Issues in Bioethics. Encino, California: Dickenson Publishing Company, Inc. (16250 Ventura Blvd., Encino, California 91436), 1978.

Practical for classroom use, this anthology contains 87 brief selections organized under six major headings: Moral and Conceptual Foundations; The Professional-Patient Relationship; Life and Death; Allocation; Human Experimentation; Biomedical and Behavioral Technologies. Where possible, opposing views are juxtaposed; each chapter includes an introduction by the editors and suggestions for additional reading.

Beers, Roland F., Jr., and Edward G. Bassett, eds. Recombinant Molecules: Impact on Science and Society. New York: Raven Press, 1977.

Focuses on technical advances in recombinant molecule technology, but includes one section on social and policy issues.

Beyerchen, Alan D. Scientists Under Hitler. Politics and the Physics Community in the Third Reich. New Haven, Connecticut: Yale University Press, 1977.

Details the responses of German physicists, individually and as a professional group, to the Nazi regime from 1933 to the end of the war. The book is based, in addition to usual sources, on a variety of unpublished materials as well as the author's interviews with some of the physicists involved.

Bugliarello, George. "A Technological Magistrature." Bulletin of the Atomic Scientists 34, January 1978: 34-37.

The author calls for a mechanism to "bind technology, values, and engineering systems."

Burt, Robert A. "The Limits of Law in Regulating Health Care Decisions." The Hastings Center Report 7, December 1977: 29-32.

A cogent, critical and well-written analysis of the need for legal reforms to regulate biomedical technology. Burt focuses on the "special dangers in succumbing too readily to this attitude," arguing that the "impulse to bring rational order to the social deployment of biomedical technology has inhumane and brutalizing implications."

Casper, Barry M. "The Rhetoric and Reality of Congressional Technology Assessment." Bulletin of the Atomic Scientists 34, February 1978: 20-31.

An intensive and occasionally scathing analysis of the Office of Technology Assessment. The "realities" to which Casper alludes are what he calls the "cozy triangles" between special Congressional committees and the related federal agencies and affected industry; he asks--how does this "reality" affect the existence and effectiveness of OTA?

Clark, Dawn. "An Industrial Survey of the Marketability of the 'Humanities Perspectives on Technology' Minor." HPT News 12, January 1978: 1-9.

The cold, hard facts about the commercial worth of an educational program which adds more extensive study of the humanities to an engineering education. While there is no encouragement for the marketability of a major in this area, industrial representatives did indicate to the author that they were receptive to programs which prepared students for professional-level understanding of the economic, social, or environmental implications of new products and processes.

Crawshaw, Ralph S. "The Tattletape Tale." Journal of the American Medical Association (JAMA) 239, 13 February 1978: 621-622.

A brief commentary on the proliferation of library surveillance systems in medical school libraries and some personal but pertinent comments on the situation in medicine (and all academe) in which: "Developing and maintaining a personal ethic seems incidental to accumulating books and book learning." He reminds us that in the "repressive scholastic world of the Middle Ages," books were chained to the walls.

"Creation at Michigan State." Scientific American, December 1977: 87.

Brief description of a Michigan State University biology course taught by the author of a biology text which "espouses the biblical view of creation." The article quotes the instructor as describing his course as one which compares evolution and creationism.

Culliton, Barbara J. "Recombinant DNA Bills Derailed: Congress Still Trying to Pass a Law." Science 199, 20 January 1978: 274-277.

An overview of the year-long and, thus far, unsuccessful efforts by Congress to pass legislation governing research with recombinant DNA.

Davis, Ray Jay, and Lewis Grant, eds. Weather Modification: Technology and Law. Boulder, Colorado: Westview Press, 1978.

Papers resulting from a 1976 conference on the legal and scientific uncertainties of weather modification, which instigated communication between experts on the technological prospects and the legal ramifications. Several of the authors describe prospective regulations or legislative remedies; a section of four papers is devoted to the interaction of scientists and lawyers.

Davis, Sandra O. "Beyond Tokenism--Are Support Programs Necessary for Women Engineering Students?" New Engineer 7, February 1978: 22-29.

Synopsis of a recent major study of students at seven engineering schools. Women engineering students have wider, more diverse interests; they acknowledge the need and benefit of support and encouragement, but they also may confront a qualitatively different experience as students.

Dundes, Alan. "Science in Folklore? Folklore in Science?" New Scientist 76, 22/29 December 1977: 774-776.

The author first describes how lampoons of the methods and ethics of scientists exist within the general folklore of our culture; he then turns to the communication of ideas about science within popular culture (in this instance, movies and television). Primarily an anecdotal article, it does point out that "one measure of the impact science has had on the modern world lies in the artistic efforts it has inspired."

Eisenberg, Leon. "The Social Imperatives of Medical Research." Science 198, 16 December 1977: 1105-1110.

Acknowledging current concerns with the dangers of medical research and practice, Eisenberg argues that impeding medical research, no less than performing it, also has ethical consequences. Illuminating historical examples demonstrate vividly that the current concerns are not novel.

Elkana, Yehuda, Joshua Lederberg, Robert K. Merton, Arnold Thackray, and Harriet Zuckerman, eds. Toward a Metric of Science: The Advent of Science Indicators. New York: John Wiley & Sons, Inc., 1978.

Edited papers from a 1974 conference led by Fellows at the Center for Advanced Study in the Behavioral Sciences. The goal of the conference and resulting book has been to initiate debate and to define the issues involved in the development of social indicators used to measure the health and state of U.S. science. The twelve papers included here are substantial, often reflective and quite detailed in their analyses. They concentrate on the particular question of whether or not these indicators measure what they purport to measure and, if so, how well. A book which will doubtless prove of use not only to persons in policy studies or sociology but also as a demonstration of intensive analysis of a new instrument for the "measurement" and study of science.

"Engineering Education Today." Impact of Science on Society 27, October-December 1977.

In his introductory "Comment" to this special issue, Alan Goodyear reminds us that "while foreign specialists are called upon in the course of importing technology developed, any country would prefer to have its own experts capable of making the required technical decisions...." The programs and plans for training engineers in several different countries--among them Mali, France, USSR, and China--emphasize the difficulties and rewards of these ventures. In addition, two articles on innovative teaching systems

assess both the value and methods of such programs for developing countries. W. Fishwick, in "The Engineering Professor's Dilemma," 369-377, writes a clear narrative of the forces at work in the engineering classroom and marketplace and makes some recommendations based on the British experience.

Epstein, Samuel S., William J. Monsour, and Claire Nader, eds. Science, Technology and the Public Interest: Information, Communications and Organizational Patterns. Jeannette, Pennsylvania: Monsour Medical Foundation, 1977.

A report on an October 1973 conference which focused on professional responsibility and the public interest, and new mechanisms for encouraging collaboration between public interest groups and technical specialists. The 122-page report includes papers by Ralph Nader, Björn O. Gillberg, and George Wald.

"Ethical Aspects of Psychiatry in Government Service." Psychiatric Annals 8, January 1978: 4-94.

Articles in this special issue include:

1) Dana L. Farnsworth, "Ethics and the World Congress;"
2) Alfred M. Freedman, "Ethics in Psychiatry: A Question of Allegiance;"
3) Clarence D.D. Blomquist, "What Is Psychiatry and What Is Ethics?"
4) Helmut E. Ehrhardt, "Ethical Problems in Psychiatric Practice;"
5) Frank C.R. Chalke, "Prison Psychiatrists: A Survey of Ethical Guidelines;" and
6) Eduard A. Babayan, "Legal Aspects of Psychiatry in the Soviet Union."

Fairfax, Sally K. "A Disaster in the Environmental Movement." Science 199, 17 February 1978: 743-748.

A skeptical view of the National Environmental Policy Act of 1969 (NEPA), regarded by supporters as a significant reform and the source of increased citizen participation. Fairfax argues that "far from being a salubrious process... NEPA has been a disaster for the environmental movement and for the quest for environmental quality."

Farley, John. The Spontaneous Generation Controversy from Descartes to Oparin. Baltimore, Maryland: Johns Hopkins University Press, 1977.

An ambitious multifaceted study by a biologist of the complex history of spontaneous generation controversies.

Fields, Cheryl M. "Congressmen Will Try Again on Regulation of DNA Research." The Chronicle of Higher Education, 21 February 1978: 6.

Report on recent efforts in the Congress to devise legislation to regulate recombinant research.

Florman, Samuel C. "Engineering and the Female Mind." Harper's, February 1978: 57-63.

A perceptive analysis of the problems confronting the engineering profession

in its efforts to recruit more women to the field. At the root of the problem, according to Florman, is "upper class aversion to engineering."

Fried, Charles. Right and Wrong. Cambridge, Massachusetts: Harvard University Press, April 1978.

The author argues for a "system of morality that makes place for that which is right or wrong in itself," and not just according to the consequences of the action. Fried's theory of individual rights accounts for the obligation to contribute to the welfare of others but also for the limits of that obligation. Based within the field of law, this book has import for those also concerned with ethical and social values impact of science and technology.

Gamble, P.J. "The Berger Inquiry: An Impact Assessment Process." Science 199, 3 March 1978: 946-952.

Describes the process used by a team in Canada to assess the impacts--social, economic, and environmental--of a large and technologically innovative pipeline project. Highlights the role of citizen groups and their effects on the outcome of the inquiry.

Goldman, Steven L. "Towards a Theory of the Humanities: A Conference Report." HPT News 3, December 1977: 10-12.

An instructive critical analysis of a recent conference on the humanities. Persons currently planning conferences might read this report for some constructive suggestions on speakers and format.

Gray, Bradford. "The Functions of Human Subjects Review Committees." American Journal of Psychiatry, August 1977: 907-910.

After describing the purposes for which committees to review research involving human subjects were established, the author expresses concern about several "unintended" or "emerging" functions of these groups, and the possible politicization of review committee procedures.

Hammond, Kenneth R., ed. Judgment and Decision in Public Policy Formation. Boulder, Colorado: Westview Press, 1977.

Articles by social scientists, political scientists, and government officials address the specific subject of judgment and decision. How technical and scientific information and judgments are weighed with public risk, needs, and benefit in the formation of policy.

Harris, John. "The Blowout at Yucca Flat." The Nation, 14 January 1978: 18-20.

Description of the human tragedy and resulting legal disputes surrounding the accidental release of radiation following the December 1970 underground test detonation of a nuclear bomb.

Holton, Gerald. The Scientific Imagination. New York: Cambridge University Press, 1978.

The essays in this volume illuminate the way in which the imagination of the scientist functions in the early phases of the formation of a scientific idea. Holton's insightful analyses reveal that in certain crucial cases a scientist adopts an explicit or implicit presupposition--or thema--that not only guides his own work but also helps determine the acceptance of his scientific insight. Thus, the public process of validation is linked with the private process of creation. Cases examined include twentieth-century scientists such as Einstein, Fermi and Millikan.

Jaki, Stanley L. The Road of Science and the Ways to God. Chicago, Illinois: University of Chicago Press, 1978.

Originally presented as the Glifford Lectures for 1975 and 1976, these essays employ themes in the history and philosophy of science to pursue the connection between scientific creativity and natural theology.

Kastenbaum, Robert. Death, Society and Human Experience. St. Louis, Missouri: Mosby-Times Mirror, 1977.

An introduction to the historical and social aspects of death and dying in U.S. society--the religious and moral attitudes, new innovations in care of the dying, and the economic aspects of changes in care and attitudes.

Kevles, Daniel J. "Physicists and the Revolt Against Science in the 1930's." Physics Today 31, February 1978: 23-30.

In an article extracted from his recent book, The Physicists, Kevles concentrates on the cosmic-ray dispute between Millikan and Compton--a falling out which was highly publicized and which Kevles indicates may have aggravated some of the contemporary public attacks on science.

Kevles, Daniel. The Physicists: The History of a Scientific Community in Modern America. New York: Alfred A. Knopf, 1978.

An insightful and well-written study of the American physics community from the late 19th century to the present. Particular attention is given to the public posture of the community in its relation with the larger society.

Kimche, Lee. "Science Centers: A Potential for Learning." Science 199, 20 January 1978: 270-273.

Despite the proliferation in the last decade of science-technology centers and their apparent popularity with the public, little is known about their educational effectiveness. The author, formerly executive director of the Association of Science-Technology Centers, focuses on unanswered questions and outlines a research agenda.

Knepler, Henry. "The New Engineers." Change, June 1977: 30-35.

Changes in engineering school curricula brought about by social pressures and the realization that social, political, ecological, etc., influences are just as important as technical feasibility. STS and STV programs in engineering schools are cited as further examples of academic concern for the engineer's new role in society.

Kolata, Gina Bari. "Clinical Trials: Methods and Ethics are Debated." Science 198, 16 December 1977: 1127-1131.

Report of a National Conference on Clinical Trials Methodology held in October 1977.

Kuhn, Thomas S. The Essential Tension, Selected Studies in Scientific Tradition and Change. Chicago, Illinois: University of Chicago Press, 1977.

Fourteen essays (several previously unpublished) that explore "the nature of scientific change" and the evolution of Kuhn's work in the history and philosophy of science. The first section of essays concentrates on the nature of history, in the abstract but also by illustration of the results of Kuhn's research; the second, on metahistorical and philosophical questions of scientific endeavor.

Larson, David M. "The 'Two-Cultures' Split and the Science Fiction Course." HPT News 3, December 1977: 1-4.

Suggests an alternative to the traditional type of introductory science fiction course which has not, the author feels, sought to probe the attempts of contemporary writers "to illuminate the relationship between science and human values." The article gives extensive explanation of the instructor's examples of the type of analysis stressed. (Also see the article following--Barbara Bengels, "The Teaching of Science Fiction--Another View," HPT News, December 1977: 4-6).

Lawless, Edward W. Technology and Social Shock. Brunswick, New Jersey: Rutgers University Press, 1978.

A discussion of the social and environmental side effects of technology--including forty-five specific case studies on "big" and "little" technological advances such as the Alaska oil pipeline and deodorant sprays.

Leeper, E.M. "Academy Accelerates Human Rights Activities." Bioscience 28, February 1978: 141-143.

The actions and reactions of the U.S. National Academy of Sciences to the subversion of the human rights of scientists in many countries outside the U.S. The article describes the procedures followed by the NAS Committee on Human Rights in the identification and investigation of "individual scientists, engineers, or doctors being repressed for political reasons."

Leeper, E.M. "Gilbert Omenn: The President's Life Scientist--Life Sciences Issues High on OSTP Agenda." Bioscience 28, January 1978: 9-12, 67.

An interview with the Assistant Director for Human Resources and Social and Economic Services of the Office of Science and Technology Policy.

Leeper, E.M. "Science and Technology for Development--USA Readies Position for 1979 UN Conference." Bioscience 28, February 1978: 85-87.

Article on the preparations for the 1979 United Nations Conference on Science and Technology for Development (UNCSTD). The author analyzes the U.S. plans and the attitudes of various institutions--e.g., labor, industry, the Congress--some of which view the conference with uneasiness.

Legal-Institutional Implications of Wind Energy Conversion Systems (WECS): Executive summary report to the National Science Foundation, NSF Report No. NSF/RA-770204. Washington, D.C.: Program of Policy Studies in Science and Technology, The George Washington University, September 1977.

An extensive analysis of windmills and like instruments or systems-- their technical, economic, and social context and the varieties of legal and quasi-legal questions involved in siting or operation or in the problems associated with utility regulation. Intriguing discussions of the liabilities and responsibilities and the economics of both land-based and offshore configurations are included. In general, this report points out the complexity of introducing a new technology into a society which is now sensitive to potential hazard and which insists upon extensive analysis of hazards and effects before the first puff of wind hits the blades.

Lepkowski, Wil. "The Saccharin Debate: Regulation and the Public Taste." The Hastings Center Report 7, December 1977: 5-7.

Values and policy alternatives in the debate about the regulation of saccharin. In the same issue of the Report, see also "The First Ban: How Teddy Roosevelt Saved Saccharin," by Carol Levine, for a description of early (1906) efforts to regulate the sweetener.

Levine, Carol. "Sharing Secrets: Health Records and Health Hazards." The Hastings Center Report 7, December 1977: 13-15.

Report of the National Conference on the Health Records Dilemma, sponsored in Fall 1977 by the nongovernmental National Commission on Confidentiality of Health Records.

Lucoff, Manny. "Telecommunications Management and Policy: Who Governs?" Journalism Monographs 51, November 1977: 37.

An analytic history of "the manner in which the nation's telecommunications resources have been managed," how policy has been developed, and how well the advice of studies, reports, and hearings has been utilized. Most of this monograph concentrates on the development and actions of the Office of Telecommunications Policy.

Mankiewicz, Frank, and Joel Swerdlow. Remote Control: Television and the Manipulation of American Life. New York: Times Books, 1978.

Mankiewicz and Swerdlow explore, in great depth, the social and cultural impact of a technology often neglected by scholars in the STS or STV fields. Is it perhaps that we are too familiar with television, that it is so much a part of our lives (and, for some, our classrooms) that we are reluctant to focus serious attention on it? This book is a trade book, not a scholarly study; but its strong, diverse bibliography and excellent summaries of the major research studies recommend it to persons interested in the impact of technology on cultural attitudes and values. Specific chapters on violence and on the effect of television of racial attitudes and sex roles contain many pertinent case studies, anecdotes, and summaries of supporting research evidence.

McMullin, Ernan, ed. Death and Decision. Boulder, Colorado: Westview Press, 1978.

Essays in this volume focus on the moral, medical, legal and economic factors in the death-decision. Authors include H. Tristram Engelhardt on "Definitions of Death," Eric J. Cassell on the function of medicine, Thomas C. Schelling on "Strategic Relationships in Dying," and William F. May on "The Right to Die and the Obligation to Care."

Mistichelli, Judith, and Christine Roysden. Beyond Technics: Humanistic Interactions with Technology, A Basic Collection Guide. Bethlehem, Pennsylvania: Humanities Perspectives on Technology, Lehigh University, 1978.

An annotated guide to books which consider technology from humanistic points of view. Entries include interviews, anthologies, and historical and case studies of the interaction of technology with art, literary criticism, fiction, science fiction, poetry, social impact, technology assessment, philosophy, and ethics.

Morris, Richard Knowles, and Michael W. Fox. On the Fifth Day: Animal Rights and Human Ethics. Washington, D.C.: Acropolis Books Ltd., April 1978.

An anthology on the complex issue of the relation of human ethical principles to the lives of animals. The diverse essays range from discussion of anthropocentrism in ethics and religion to analysis of cruelty to animals. As the recent ban on the export of rhesus monkeys has dramatically shown, the relationships between animal rights, human ethical principles, and human attitudes toward animals can have a direct impact on scientific research.

National Bureau of Standards. Copyright in Computer-Readable Works: Policy Impacts of Technological Change. Washington, D.C.: U.S. Government Printing Office, 1977. $4.00; Stock number 003-003-01843-1.

Recommendations for a clarification of the copyright laws to include protection for "computer-readable works," particularly data bases and source programs.

National Science Board. Science Indicators 1976. Washington, D.C.: National Science Foundation, 1977. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. $4.75; Stock number 038-000-00341-1.

The indicators in this report, the third in the NSB's Science Indicators series, deal primarily with resources--human and financial--for research and development in various sectors of the economy. The chapter on "Public Attitudes" summarizes a number of recent surveys, including one commissioned specially for this volume.

National Science Board. Strengthening Environmental Programs. Washington, D.C.: U.S. Government Printing Office, 1977. $1.40; Stock number 038-000-00348-8.

This NSB report focuses on two areas of environmental research in which it feels that "less than adequate effort" is being made--water resources and climate change. Four research areas are singled out as worthy candidates for increased support and involvement.

National Science Foundation. Proceedings of the RANN 2 Symposium. Washington, D.C.: U.S. Government Printing Office, 1977.

The RANN 2 Symposium brought together researchers, users of research in industry and government, and science policymakers at the national, state, and local levels to report on current and prospective RANN activities and to foster the interchange of ideas and concerns between users and providers of research. The Proceedings record the substance of the symposium, including formal papers, questions and answers exchanged during the sessions, and summaries of the roundtable discussions which addressed the relation between science and society, and the application of scientific and technological knowledge for socially useful purposes. The six-volume set of proceedings includes: General Information and Plenary Sessions; Using Natural Resources; Improving Productivity; Coping With Man-Made and Natural Hazards; Improving Government Responsiveness to Public Needs; and Regulation.

Personal Privacy in an Information Society. Washington, D.C.: U.S. Government Printing Office, 1977. $5.00; Stock number 052-003-00395-3.

The findings and recommendations of the Privacy Protection Study Commission, which recently concluded its investigation of government and commercial, public and private, U.S. data bases on individuals. The report describes the ways in which private information can become public knowledge and advocates the establishment of a national policy on the collection, use, and disclosure of records about individuals.

"Perspectives on NBS." Dimensions 62, January 1978: 8-19.

This special group of articles includes accounts of testimony at the National Bureau of Standards oversight hearings in the U.S. House of Representatives, Fall 1977:

Jordan J. Baruch, "The Future of NBS," 8-10, an assessment by the Commerce Dept. Assistant Secretary for Science and Technology; Ernest

Ambler, "Problems, Prospects, and the Search for a Proper Balance," 10-14, the then-nominee for NBS Director describes his view of the situation; Charles E. Peck, "Warnings and Recommendations," 15-17, the view from industry; and William O. Baker, "A Current Assessment," 18-19, testimony from a member of the NAS-NRC panel convened to evaluate the NBS.

Pickett, William B., ed. Technology at the Turning Point. San Francisco, California: San Francisco Press, Inc. (547 Howard Street, San Francisco, CA. 94105), 1977.

Six engaging articles on the history and future of American technology, originally presented at a 1976 conference at the Rose-Hulman Institute of Technology. In addition to an introduction by the editor, the 75-page volume includes: "Edison's Method," by Thomas P. Hughes; "Women and Technology in American Life," by Ruth Schwartz Cowan; "Technology The Liberator," by Melvin Kranzberg; "Public Funds and Private Technology," by Paul Horwitz; "Computers and Hope," by Joseph Weizenbaum; "The Future of American Technology," by Victor Ferkiss.

Portugal, Franklin H., and Jack S. Cohen. A Century of DNA: A History of the Discovery of the Structure and Function of the Genetic Substance. Cambridge, Massachusetts: The MIT Press, 1978.

The first comprehensive account of the theoretical and experimental work on "the chemical nature and three-dimensional structure of... naturally-occuring nucleic acids and... the nature and basis of heredity in living organisms." Based on both written records and extensive personal interviews, the book opens a window onto the complex intellectual interconnections which characterized the work on which the Watson-Crick discoveries were based and from which the subsequent work on recombination developed. Full of photographs of the principal actors and clear illustrations of scientific principles, this book should prove to be a useful reference for scientists, for historians of science and for others interested in the history of ideas in science.

Powledge, Tabitha. "Recombinant DNA: Backing Off on Legislation." The Hastings Center Report 7, December 1977: 8-10.

Why scientists and congressmen changed their minds in Fall 1977 about the need for legislative regulation of recombinant DNA research.

Ramaley, Judith A., ed. Covert Discrimination and Women in the Sciences. Boulder, Colorado: Westview Press, 1978.

A book which concentrates on the legal issues, but also on the psychological and social barriers to professional development of women in the sciences. Authors explore 1) the definition and context of discrimination, and what federal and local programs have been implemented to remove discriminative practices; 2) the pressures that can deflect women from scientific careers; and 3) the interplay between individuals and institutions during promotion and tenure of women scientists. The essays ask: if there are differences

in the ways that the performances of men and women are judged, how can this situation be changed?

Report of the Committee on Human Rights of Mathematicians. Notices (American Mathematical Society) 24, November 1977: 431-432.

This AMS Committee has gathered information on individual cases and on the general situations regarding repression of intellectuals in a number of countries. The cases of five mathematicians on whose behalf the Committee has written letters of protest are described in brief.

Rodgers, Daniel T. The Work Ethic in Industrial America, 1850-1920. Chicago, Illinois: The University of Chicago Press, 1978.

An exploration of the changes in the work ethic at a critical time in U.S. history. Technological developments were facilitating increased industrialization and had introduced important changes in the methods and institution of work. Rodgers argues that fears that the factory system would bring moral decline stimulated the development of measures to preserve the existing work values. These measures proved not enough, however, and the author chronicles and analyzes the resulting changes in American work values.

Rosenberg, Charles E. "Rationalization and Reality in the Shaping of American Agricultural Research, 1875-1914." Social Studies of Science 7, November 1977: 401-422.

The author traces contemporary controversy over the quality and social vision of American agricultural research to the shaping attitudes of the agricultural experiment research station scientists at the turn of the century. Belief in the "family farm" was contradicted by the reality of the fact that the principal beneficiaries of the research were the larger farmers and agricultural businesses. The promises of increased productivity--"to make two blades of grass flourish where one had before"--were part of a value-system which saw pure science as a necessary foundation for applied science, but which led eventually to conflicts between the demands of pure research and the needs of the farmer-constituent.

Sagan, Carl. "'There's No Hint of the Joys of Science.'" TV Guide, 4 February 1978: 6-8.

Criticism by a scientist of the type and quality of science shown in television news and entertainment programs. Sagan's prime complaint is that television stresses the dangers rather than the joys of scientific research.

Schmeck, Harold M., Jr. "Special Rules for Gene-Splicing Patents Rejected." The New York Times, 10 March 1978: A10.

Describes an NIH decision that inventions arising from Government supported research in gene-splicing do not require special rules and should be patentable under rules that already apply to such biological inventions as vaccines.

Smith, R. Jeffrey. "Creative Penmanship in Animal Testing Prompts FDA Controls." Science 198, 23 December 1977: 1227-1229.

Recounts the discovery of "massive deficiencies" in scientific data used to approve chemicals and drugs, and the resulting new rules to be imposed by the government for laboratory testing on product safety.

Sokal, Michael M. A Guide to Manuscript Collections in the History of Psychology and Related Areas. Wellesley, Massachusetts: The Wellesley College Colloquium on the History of Psychology, 1977.

This 64-page guide contains listings and subject and repository indices for collections on psychology, psychiatry, psychoanalysis, child development, parapsychology, neurology, mental deficiency and hygiene, psychology-related university administration and philanthropy and philosophical psychology. Available for $2.50 post-paid from the author c/o Dept. of Humanities, Worcester Polytechnic Institute, Worcester, Massachusetts 01609.

Southgate, A.J. "Professional Ethics and Secrecy in Science." Search 8, September 1977: 305-307.

The author reports on a recent public scientific forum in New Zealand which concluded that there is a need for freedom of information laws and for codes of ethics for scientists. The forum also recommended development of "a special tribunal which could swiftly and impartially investigate cases in which scientists claimed that information vital to the public welfare was being kept secret." The article particularly emphasizes the barriers to communication of scientific issues directly to the public; indeed, the forum urged New Zealand scientific societies to adopt "codes of ethics emphasizing among other things the prime responsibility of scientists to inform the public."

Spicker, Stuart F., and Tristram Englehardt, Jr., eds. Philosophical Medical Ethics: Its Nature and Significance. Boston: D. Reidel Publishing Company, 1977.

Essays on the philosophical dimensions of biomedicine.

Steinfels, M. and C. Levine, eds. "The Teaching of Ethics: A Preliminary Inquiry." The Hastings Center Report 7, December 1977: Special Supplement, 20.

Copies available from the Publications Department, Hastings Center, 360 Broadway, Hastings-on-the-Hudson, N.Y. 10706. $1.50/copy, less for multiple orders. Contents: "Medicine, Biology, and Ethics," by Robert M. Veatch; "Public Policy and Ethics," by David E. Price; "Law and Ethics," by Andrew L. Kaufman; "Social Sciences and Ethics," by Donald P. Warwick; "Business and Ethics," by Max L. Stackhouse; "Politics and Ethics," by William Lee Miller; "Engineering and Ethics," by Robert J. Baum; "The Environment and Ethics," by William T. Blackstone. Also included is a bibliography with 70 entries.

Stone, Jeremy J. "Political Problems of Brazilian Science." F.A.S. Public Interest Report, Special issue, 30, November 1977.

Stone's gripping narrative of his trip to Brazil to observe the political and social conditions under which Brazilian scientists and engineers live and work. The difficulties of mounting a major scientific meeting while maintaining necessary governmental support are detailed in this report by the Director of the Federation of American Scientists.

Tarr, Joel A., ed. Retrospective Technology Assessment--1976. San Francisco, California: San Francisco Press, Inc. (547 Howard Street, San Francisco, California 94105), 1977.

Proceedings of a conference on the use of historical analysis (retrospective studies) in contemporary assessments of technologies. Contributors include practitioners of technology assessment, social scientists, humanists and lawyers. Case studies of both historical and contemporary technologies form the bulk of the volume, with additional sections on methodology, and technology and values.

Townsend, John Marshall. Cultural Conceptions and Mental Illness, A Comparison of Germany and America. Chicago, Illinois: University of Chicago Press, April 1978.

This cross-cultural study by an anthropologist, "evaluates two contemporary social-role theories (Scheff and Goffman) and attempts to reconcile them with the clinical theories;" his results indicate the need for revision in traditional cultural conceptions of mental illness and in understanding of the influence of basic cultural values on the treatment of the mentally ill.

U.S. Commission on Civil Rights. Window Dressing on the Set: Women and Minorities in Television. Washington, D.C.: U.S. Government Printing Office, 1977. $3.25; Stock number 005-000-00155-2.

A study of how minorities and women are portrayed on network television (based on analyses of network broadcasts between 1969-75) and the conditions of their employment at individual stations.

Vickers, T. "Flexible DNA Regulation: The British Model." Bulletin of the Atomic Scientists 34, January 1978: 4-5.

A brief outline of the types of government regulation undertaken in the U.K. The conduct of genetic manipulation research has been recently considered there by three working groups--the Ashby Working Paper, the Williams Working Paper, and the Genetic Manipulation Advisory Group. The article also outlines the applicability of the 1975 Health and Safety at Work, etc., Act.

Wade, Nicholas. "Gene-Splicing Rules: Another Round of Debate." Science 199, 6 January 1978: 30-33.

Controversy continues over the NIH's guidelines for recombinant DNA research, this time about proposed minor relaxations of the present rules.

Wade, Nicholas. "Laetrile at Sloan-Kettering: A Question of Ambiguity." Science 198, 23 December 1977: 1231-1234.

Although Sloan-Kettering has announced that the results of its tests of the efficacy of Laetrile were predominantly negative, an anonymous group of institute members has charged that pro-Laetrile evidence was suppressed.

Weiner, Charles, ed. History of Twentieth Century Physics. New York: Academic Press, 1977.

Proceedings of the 1972 session of the International School of Physics on the history of 20th century physics. Lectures by historians, philosophers, and political scientists are interspersed with historical reflections by prominent physicists.

Westin, Alan. "Medical Records: Should Patients Have Access?" The Hastings Center Report 7, December 1977: 23-28.

Westin places "the movement to give patients a legal right of access to their medical records" within the context of "a growing citizens' movement to affirm individual self-determination and place limits on the power of institutions to determine important aspects of people's lives without due-process-oriented procedures." This article examines legal trends, existing laws, and competing models of information control.

Wojcik, Jan. Muted Consent: A Casebook in Modern Medical Ethics. West LaFayette, Indiana: Purdue University, 1978.

Intended as a primer for non-specialists in medical ethics, this book focuses on seven controversial and active areas of modern medicine: human experimentation; genetic counseling and screening; abortion; behavior modification; treatment of the dying; allocation of scarce medical resources; and genetic engineering. Each chapter includes several fictional cases to illustrate the contemporary situation and a review of current thinking about the ethics of each area.

Ziman, John. "Scientific Solidarity." New Scientist 77, 23 February 1978, 512-518.

In the second of two articles, Ziman argues for the creation of an international clearinghouse for information on the repression of scientists. Ziman points out that "private persuasion can only be really effective if it is backed by a strong public position" of, particularly, scientific organizations and institutions. He calls also for the use of the 1948 U.N. Universal Declaration of Human Rights as a standard by which to judge the treatment and welfare of individuals.

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